

DDU5CTRL

(file 0dductrl)

10-12-2015_15:19

CMS CSC DDU5, Central Control FPGA

CF056A13

Version 56

v56: modify Tr bits 15:8 (stat-bits) for CDAQ compat; r2: fix bug in trail bus definition; r3: set S-Link reset until SysRdy
r4-r6: delay S-Link Reset 105ms & hold for 200ns, set by NJR; r7: Presync now sets BUSY before the Resync action
r8: tune BUSY, improve L1A_MT/DDU_IS_EMPTY logic; r9: fix CFEB_CNT_ERR logic for 7 DCFEBs
r10: sw6 sets backpressure On, minor fix for DAQ_Ready flag; r11: remove L1A_MT_EOE bug in DDU_IS_EMPTY
r12: require sw5&6 for GbE counter output, sw6 prevents EvCntRst on Resync; r13: require SW1 w/SW6 to disable EvCntRst

Set All I/O to 3.3V

PART=XC2VP7-6-FF672

PROM=2*XC18V04-VQ44 (PARALLEL)

DDU5ctrl\DDU5ctrl\ddu5ctrl
C056DD99
C156DD99

PromID: 05026093h

FPGAid: 2124A093h

PROGRAM takes < 55 ms (31ms this FPGA)

DDUCNTRL

1: Mode Bit 0

2: Mode Bit 1

3: Mode Bit 2 LED0 on top, pins on away-side from LEDs

4: Mode Bit 3 RST_1=Asynchronous Reset for FPGA1 and ALL FIFOs

5: Mode Bit 4; High for GBE debug, Low otherwise

6: Readout test enable: sets backpressure On

--no EvCntRst on Resync if SW1 is set

--send counter on GbE if SW5 set

7: Set L1A Fake mode, Kill TTC L1A/BXR/ECR if SW8 is off

8: FPGA version on LEDs

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DDU Format Since DDUctrl v15:

H1: 0x/51/NN.NNNN/XXX/1.II/VK

H2: 0x/8000/0001/8000/HHHH

H3: 0x/LLLL/0000/ZZZZ/GGMY

T-2: 0x/8000/FFFF/8000/8000

T-1: 0x/SSSS.SSSS/QQQQ/PPPP

TR: 0x/A/?/WW.WWWW/RRRR/UUMK

DDU WordCount (64-bit words) for "No Data" event: 0x006.
DDU WordCount for one DMB (only one CFEB): 0D2h = 210 dec, 1680 Bytes
DDU WC, 1 DMB with 2 CFEB (8 samples each): 19Ah = 410 dec, 3280 Bytes
DDU WC, 2 DMB with 1 CFEB (nCFEB=2): 19Eh = 414 dec, 3312 Bytes
DDU WC, 2 DMB with 2 CFEB (nCFEB=4): 32Eh = 814 dec, 6512 Bytes

DDU_WordCount = (6 + 25*Nts*nCFEB + 4*nDMB) < 30070: 240560 Bytes

^^Ignores TMB Data^^ GBE ByteCount = 8*DDU_WordCount 8 TS assumed

DDU5CTRL -- Project History

- To Do:
- COMPARE BXN (DMB/TMB too)
 - Watch for TRG buff overflows
 - Determine correct values to store in Flash Mem
 - > BX offset, KillCh's, FIFO thresh, Board ID
 - Test DCC/SlinkWait feedback function & thresh's
 - > Make DMB stop too
 - Verify that CFEB-CRC is fixed for B-code case
 - No logic for BUS1, DCC SBDATA & TDxxx, 4 LSF, 4 LRL
 - Make Verilog module to get Fiber/DMB_RD in one CLK?
 - Multiple TRG_L1err ought to request a Sync Reset?
 - * Same for consecutive events with a TRG_L1err?

- Check Phase of CMD to CLK40
- * pg. 2G & 3I
 - CFEB-DMB sync check pg. 12C
 - CFEB-L1A check disabled, pg. 12D: not! Found a fix...
 - options for Monitoring on pg. 3H, 12E?
 - Does CFEB-Check-Disable cause TF/SP mimic?

TST	Clock	BUFGMUX
0P	drck1	5P *4P -TR
2P	2clk	5S *1S
3S	clk	7S *7S
0S	clk625	2S- *2S
7P	ck125	1P *0S -BL
5P	clk40	0S *3P
4S-	clk156	4S- *4S
1S	drck2	3P *5S
6S-	sclk	6S- *6S

* denotes LOCed position

New Ideas: Store & check DMB source ID's from each fiber?

Default Startup Order:

- Release DLL (no wait)
 - 4) DONE
 - 5) En. Outputs
 - 6) Release WE
- Feed SLINK status into FMM logic (for UF).
- In case of StuckData send PRST? How to distinguish SEU? Later event still gets LostHdr or Timeout, could self-correct. Add "PRSTed" VME register to track occurrence.
- In case of L1Amismatch, let it run and see if it is better a few~10 evts later. Possible to self-correct as above...? Can only work if DMB really lost event data.

DDU Format since DDUctrl v15:

H1: 0x/51T/NN.NNNN/XXX/11/VK	T-2: 0x/8000/FFFF/8000/8000
H2: 0x/8000/0001/8000/HHHH	T-1: 0x/SSSS.SSSS/QQQQ/PPPP
H3: 0x/LLLL/0000/ZZZZ/GGMY	TR: 0x/A/?/WW.WWWW/RRRR/UUMK

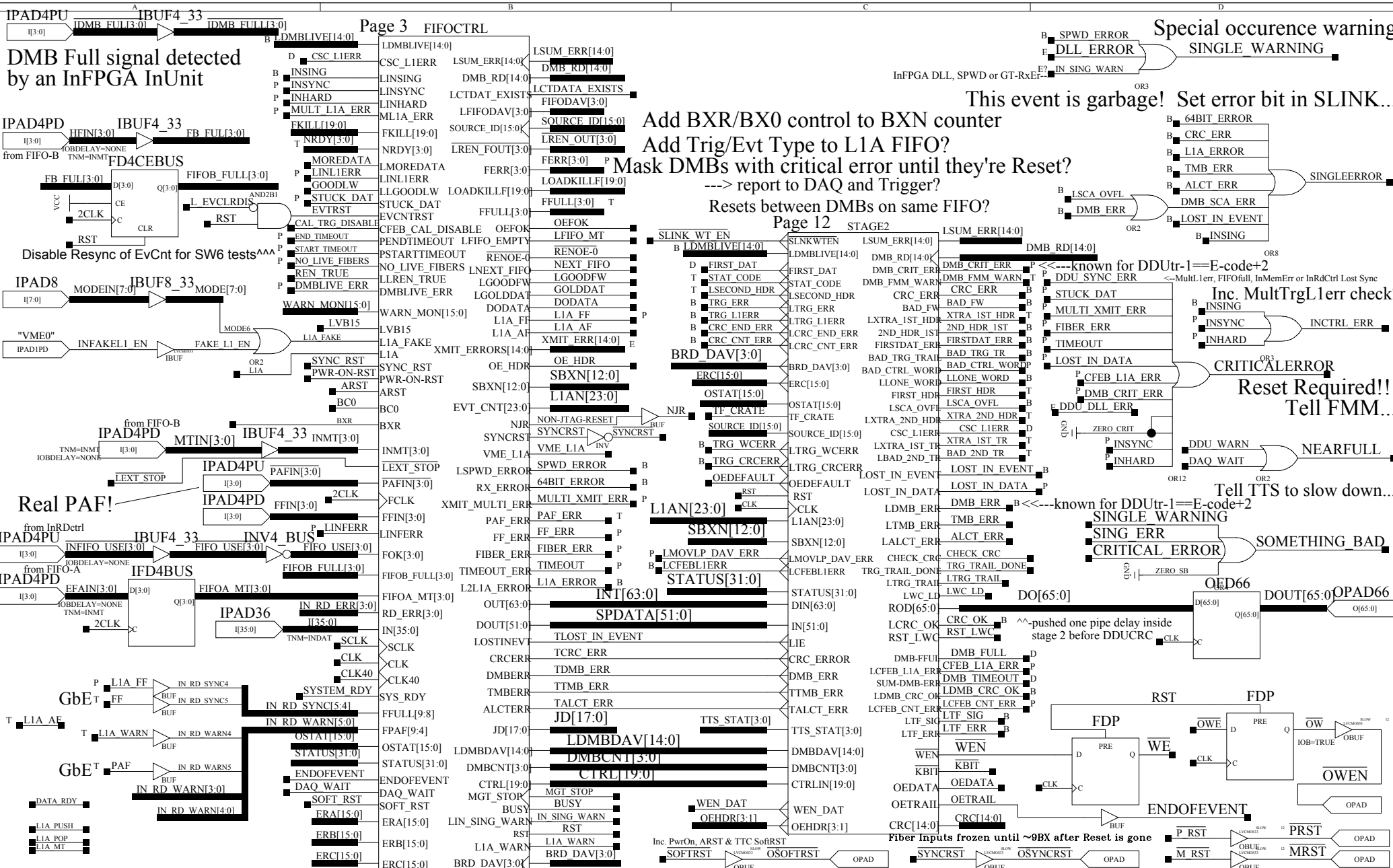
DDU WC, 3 DMB with 1 CFEB (nCFEB=3): 26Ah = 618 dec, 4944 Bytes
DDU WC, 4 DMB with 1 CFEB (nCFEB=4): 336h = 822 dec, 6576 Bytes
DDU WC, 7 DMB with 1 CFEB (nCFEB=7): 59Ah = 1434 dec, 11472 Bytes
DDU WC, 8 DMB with 1 CFEB (nCFEB=8): 666h = 1638 dec, 13104 Bytes

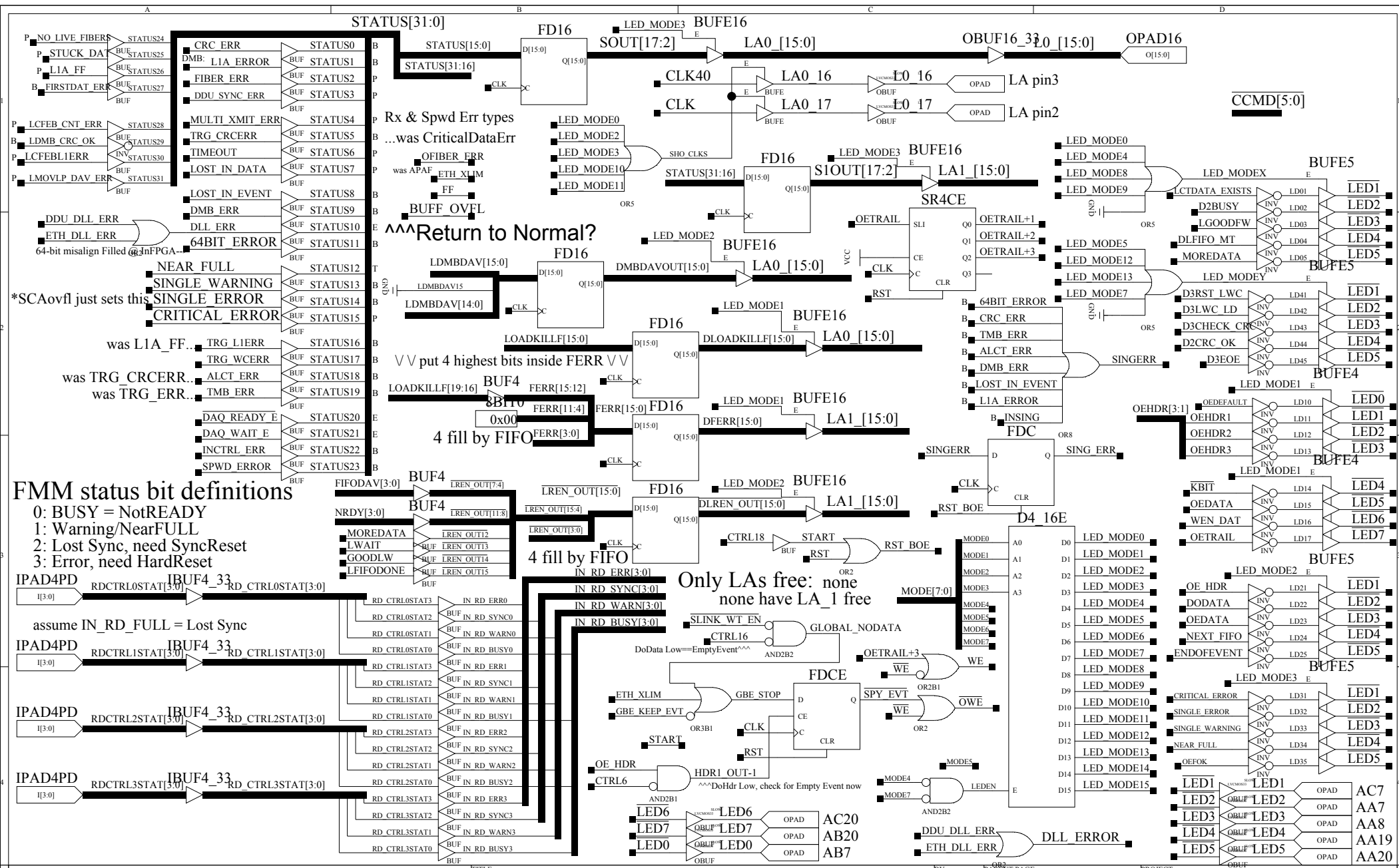
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DDU_WordCount = (6 + 25*Nts*nCFEB + 4*nDMB) < 30070: 240560 Bytes
^^Ignores TMB Data^^ GBE_ByteCount = 8*DDU_WordCount _8 TS assumed_

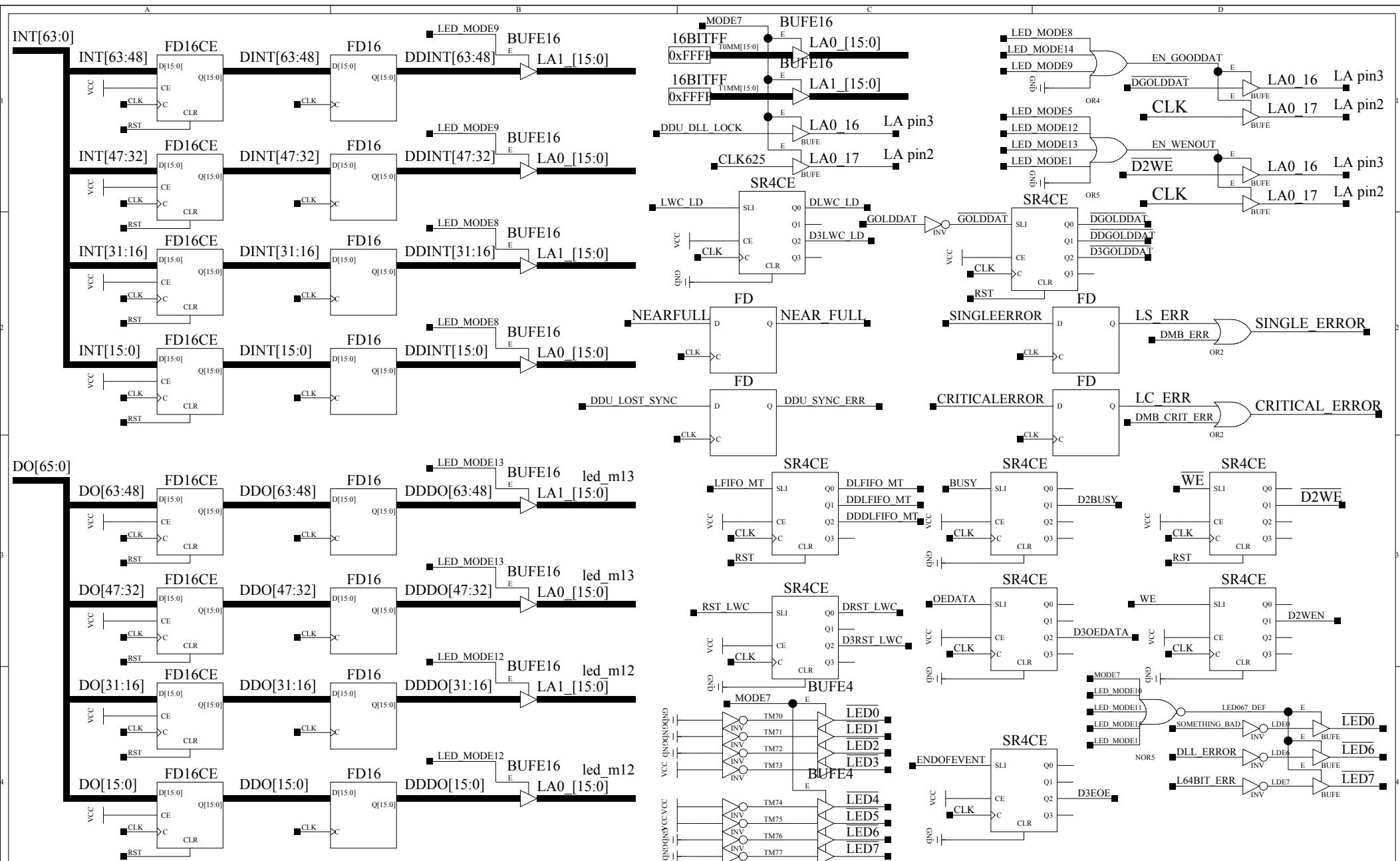
DDU WC, 11 DMB with 1 CFEB (nCFEB=11): 8CAh = 2250 dec, 18000 Bytes
DDU WC, 12 DMB with 1 CFEB (nCFEB=12): 996h = 2454 dec, 19632 Bytes
DDU WC, 15 DMB with 1 CFEB (nCFEB=15): BFAh = 3066 dec, 24528 Bytes

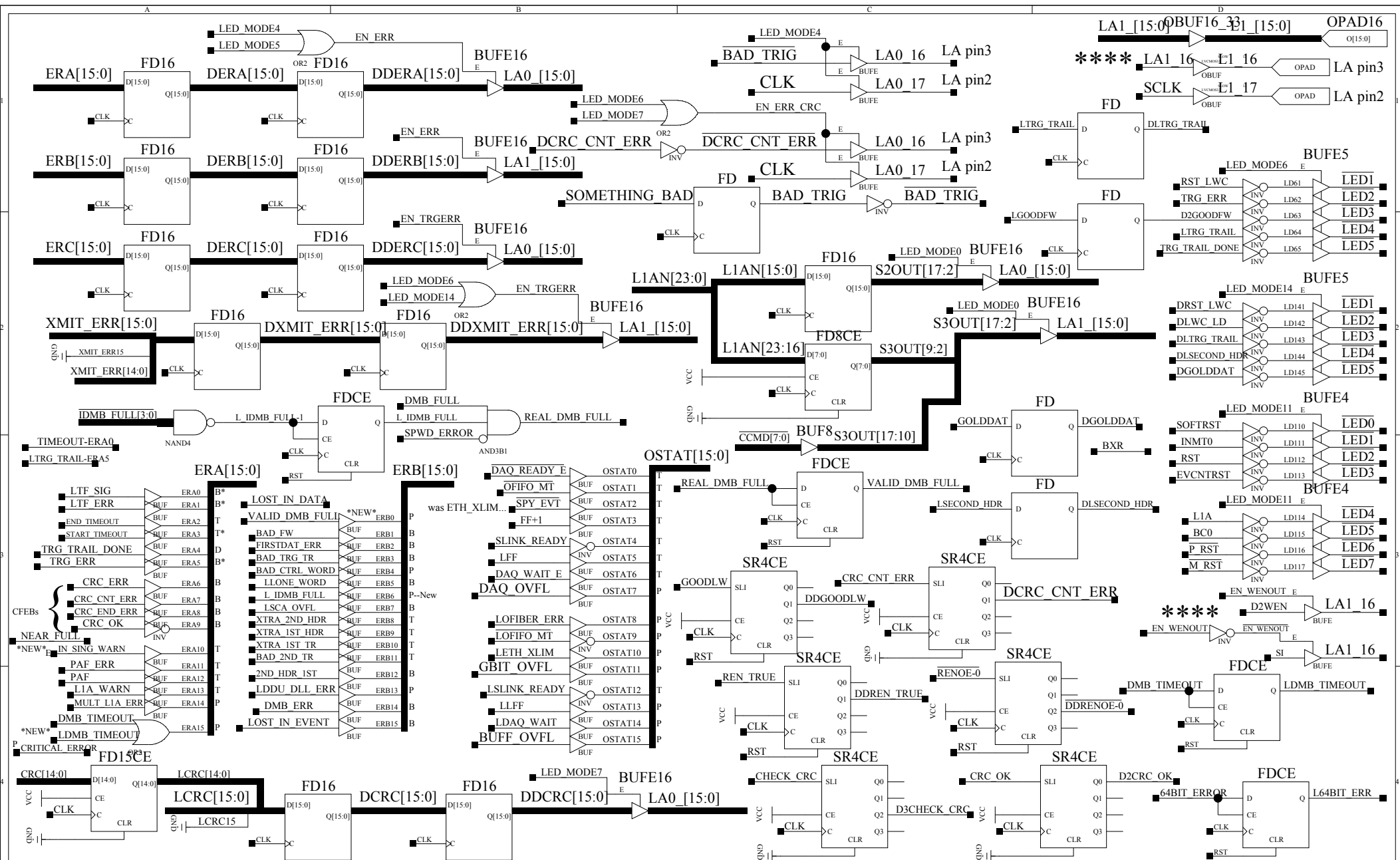
v1-2: from ddu4ctrl_v28, FIFO Full JTAG Reg is 16-bits
Last w/DDU_FOV=4 ----> v10-12: Add RCLK1, Tune OutUnit GT resets, tune DCC_WAIT modes & add Kill opti
v13-14: Fix LVT/LVA, kill DMB-CFEB-Sync, bring DMB Results to CRCerr; tune DMB checks, GbE Prescale & SLinkWtEn from VME
v15-16: fix DMBwarn, add VME_FakeL1enable; put DMBLIVE[14:0] in HDR3; put DMBwarn/err in TR-1, Tune TRG_Trail_Err resets, FOV
v17-18: tune DMB_Full, RST_InStat, EndTimeRST, PRST, add InRd-C-Code JTAG path (F20), GbE Packets now 7952 by
v19: Require SLinkWaitEn for CFEB_L1err check; v20: set RCLK0 to FAST24, CFEB to SLOW6---->rev2: SLOW
v21: add C-code-err Begin/End to JTAG F20, set CLK40-0 to FAST16, DMBliveErr & In_Time_Out go to BOE_S
v22: add DMBLIVE reg's on F25/26, CLK40-1 is FAST16, L1A uses OFD_1; rev2: CLK40's use F16-OFDD
Good! rev3: tune PDMBLIVE_EN & RST_STRT logic v23: add KillCFEBchecks & require FKILL15 to EnableCheckDisa
Good! v24: tune DMBlive timing (yellow FMM), bring signals to LEDm10/LA0
v25: tune L1err & InFerr "DMBliveOK", fix TTMB_Err, tune RstBOE, check CFEB L1A only on 1st sample (not critic
v26: BXorbit=3563 now, add IDMB_FULL flag on ERB. v27: tune CFEB_L1er, 8/16 sample flag, WarnMon & BX off
v28: add Big debug reg. on F21, Timeout reg. on F28 use LnextFIFO, replace LLLREN w/LFOE for TimeoutRd
make ERA-St/End-To perm. v29: fix Mult.L1Err logic, add InSingWarn/InMML1Err, tune DDUysyncErr, L1A-fake kills TTC-L
v30: tune Critical Error, InRdWarn, SpyOvfl & LextStop logi
v31: tune CFEB-DAV check (OR DAVs from DMB Hdr1 & Hdr2), add SP/TF compatibility & diagnostic log
v32: change CfebCalDisable default to True, remove DDU_DLL_Err from FMMerr (InRdErr4), modified ERB13 for perm DDU_DLL_4
add DDU CSC-Board occupancy monitor-F34? r2: add zeroing logic at RST for Occ.Mon. -r3: fix LRST log
v33: change SourceID=760=2F8h for TF-DDU v34: Inverted CCB_CMD bus & L1A **for TF-DDU ONLY!
v35: Autodetects TF-DDU, now compatible w/wo TF; add SyncHold & CloseL1A logic; r2, removed redun
RdyIn2 requirement for SEN bits. r3-4, OSyncRst on -Clk40, tune OFIFO Mon, req. VMEctrv17+ & InCtrlv22r
v36: non-TF DDU's have SrcID=BrdID, NoLiveFibers now readout on L1A. r2: change TF_SIG to FDRE, Reset CheckCRC with NewTFD
v37: diagnostic changes...Tune DMBL1err(notALCTerr), BadCtrl(notMissTrg), LIE(addMissTrg
DMB/TMB/ALCTerr account for MissTrgTrail, DMB-to on Era15, XtraTrgTrails on Erc5+13,DDUfmm 3-bits held Reset until Systemf
v37r2-3: tune CfebL1aErr/SyncErr & DMBcritErr logic, MultL1err logic, InSingWarn=Era10,ValidDMBfull=ErB0,DMBTimeout=Er
v38: DMBcritErr=Erc7, improve Htmb/alct timing.C-codeErr goes to InMxmitReg, InTimeout goes to EndTimeBusyR
r2: make DAQovfl for FF case only, include C-CodeErr w/MultXmitErr, CFEBerc flags Reset on BOE, C-code-L1er=FIFOb
LDMB_CRCok held at least 4 cycles
r3: add DMB-TO/FIFOfull to TMB/ALCTerr Regs, adjust their time to L2DMBrd; TrgWC only Comp 8 bits, A-T-Switch Req. NoSpwd
r4: fix LWCb8 Reset logic for long ALCT case (still not inc. in WC check throug
v39: 64bit_err reset on BOE, TrgWC now uses all 9 bits, CloseL1A range now 1usec, BIG L1Aifo w/better Warn/Busy Lo
r2: add hysteresis for L1A_AF/Busy state, tune DAQovfl logic, tune SysRdy/BUSY logic. r3: tune L1pipe/StuckData lo
-r4: tune CRC_Cnt_Err monitor logic; r5: tune SCAovfl Reset & CountSample timin
v40: DMB & Trig.CRCs use MUX to load Zeroes (not Tbufs), change DDUfb res
-r2: add time constraint to DDUFB reg to eliminate DDU/CRC logic lag, r3: tune BuffOvfl & EthLim lo
v41: SCA_Ovfl separated from DMB_Err & SomethingBad. r2: tune KillFiber glitc
v42: change to proposed format for ALCT; r2: FOV=6, on TFSig kill ALCT/TMBerr, correct SBXN fi
3564-4096 difference in BX<40 case (from CloseL1A logic) r3: change to new ALCT/TMB data forma
r4: fix TRG bugs in stage2 r5: reduce RST logic delays, may have caused TrgTrail detect problem
added bit usage notes in FIFOCTRL, 27nov2007 v43: tune CMD Strobe timing; r2, adjust TMB/ALCT Fful b
r3: fixed bug in TrgL1err reporting. v44: change TF-DDU definition (0xc0 in Flash-Page
v45: tune TrigTrailProb, CfebCntErr logic, add CSC RepeatErr logic to LsumErr reg & take it to JTAG F
r2: remove DMBwarn from FMMwarn logic. r3: add vote3 for DDUCRC r4: remove CRC voting, delay S-Link clock by 3.
v46: tests ck156, SLink clk from DCM --> SLink. r2: shift OWCLK by +3.2ns v47: move ROD pipe reg. into stage2 before DDUCRC
v48: GbE skips Empty Events for Global run
v49: add SYSTEM_RDY diagnostics on LA0 mode 11; r2: add ChBond code for DCC r7: ChBond
v50: hold back Resync until Empty for TFDU; v51: new ChBond method; r2: ChBnd runs free sync r
r3: add special Idle sequence for DCC; r4: change special Id
v52: prevent backpressure response during DoFW phase, may allow 7 words to DC
r2: replace all EvtCntRst functions with RST; r3: edit RstStop logic, remove ~DoDat; fix DDU_IS_EMPTY startup l
r4: tune DDU_IS_EMPTY wait for EOE logic v53: change LinkRdy->DCCwait logic, store both for EOE status reg
v54: add DCC Preamble (default) plus ForceIdle logic states r2: fix WantRen logic, tune DoIdle & OSTAT fi
v55: DMB format and SrcID + S-Link changes for 2014 r2: force GbE FOK input signal High. r3: fix bug & try a
r4: fix kill_alct/tmb handling in TrgTrail logic, modify FOK_GBE bypass to use ModeBit4, set ModeBit7 to ignore S-Link
r5: fix logic for DMB HalfFull (low true) in Stage

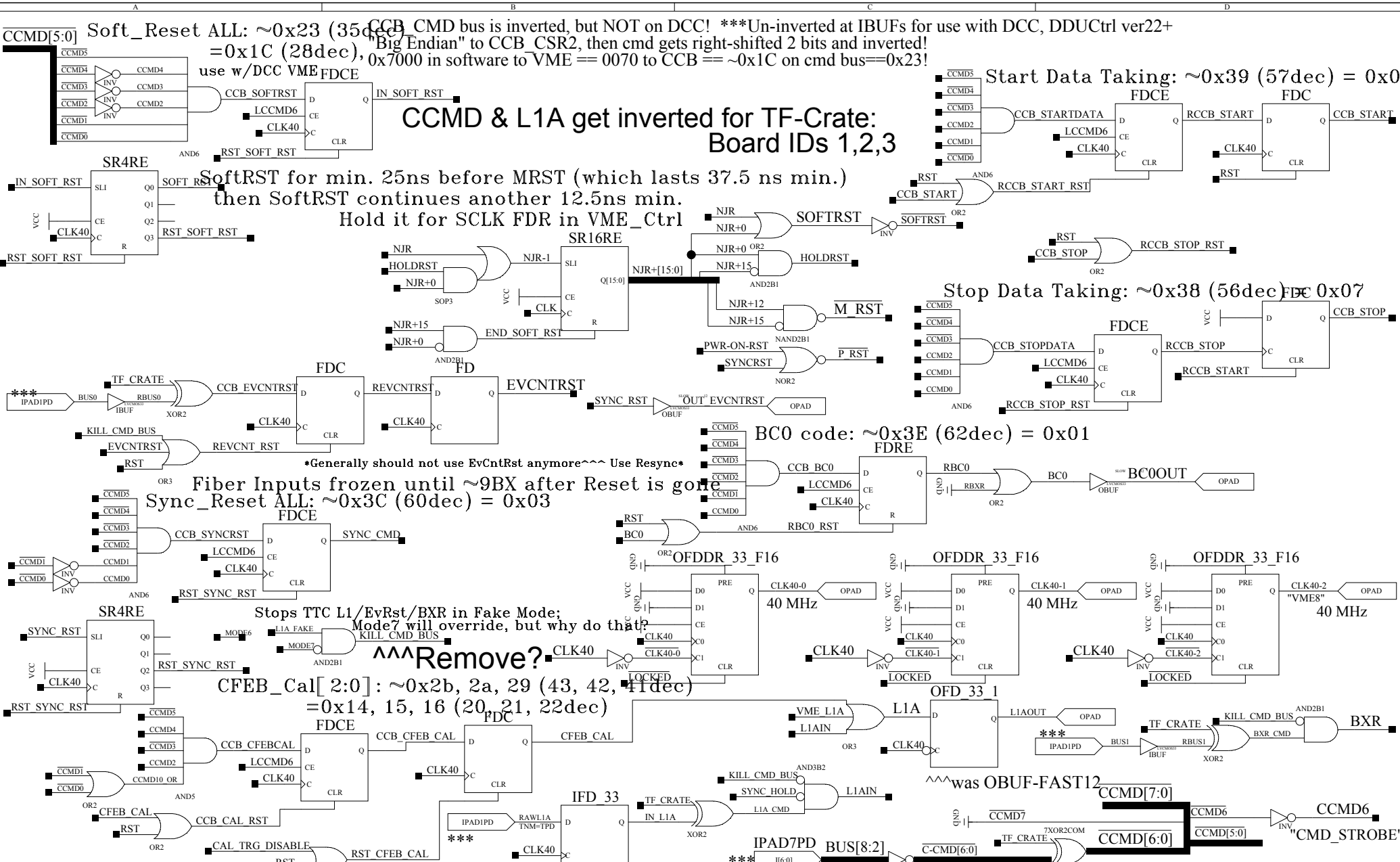
CSC L1Err<--Bring to VME-JTAG Reg?

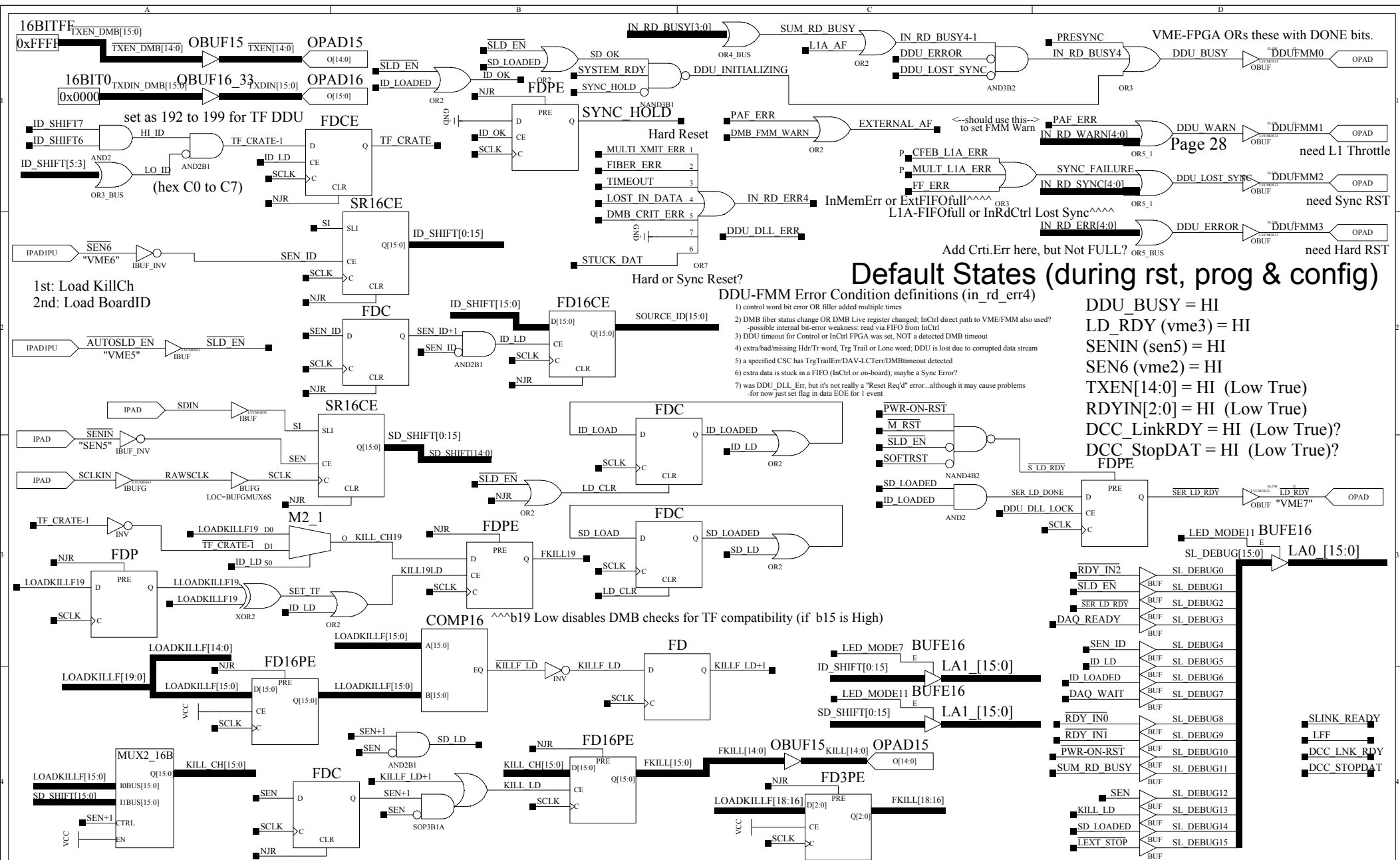












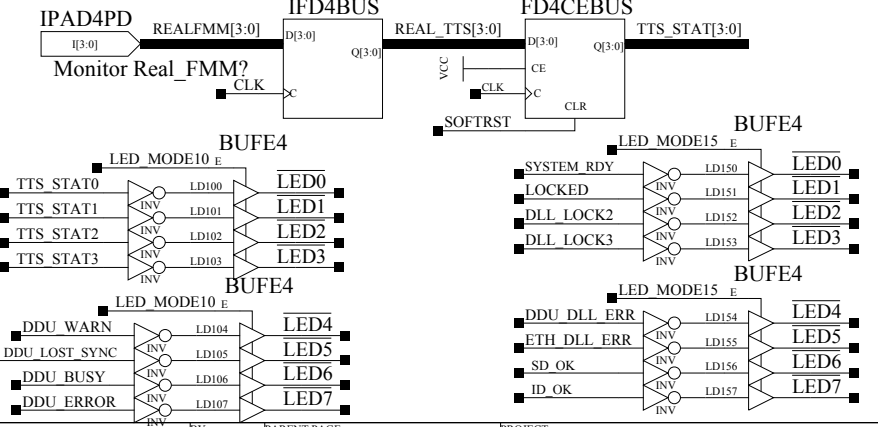
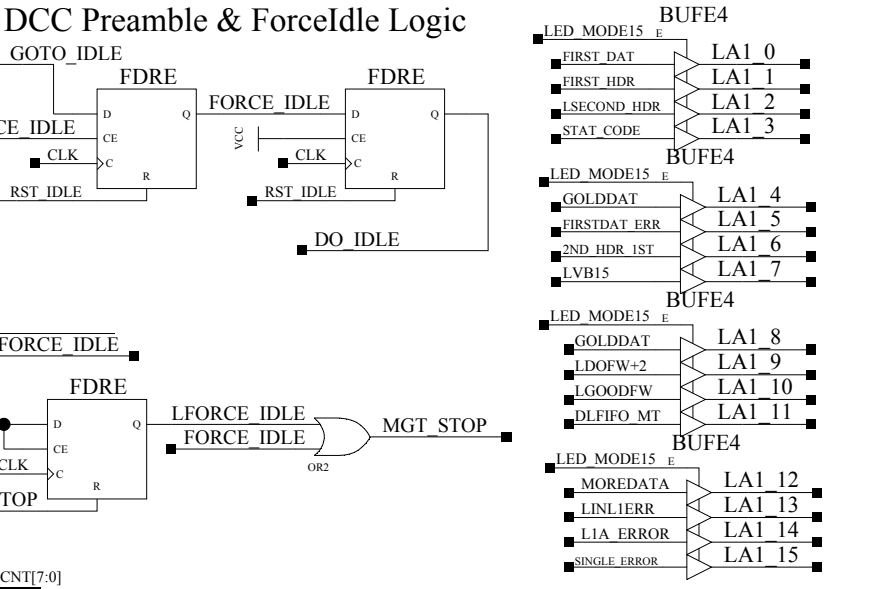
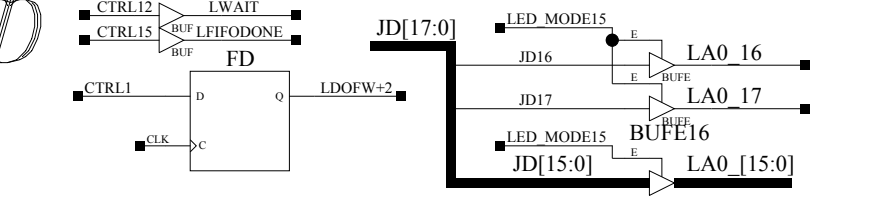
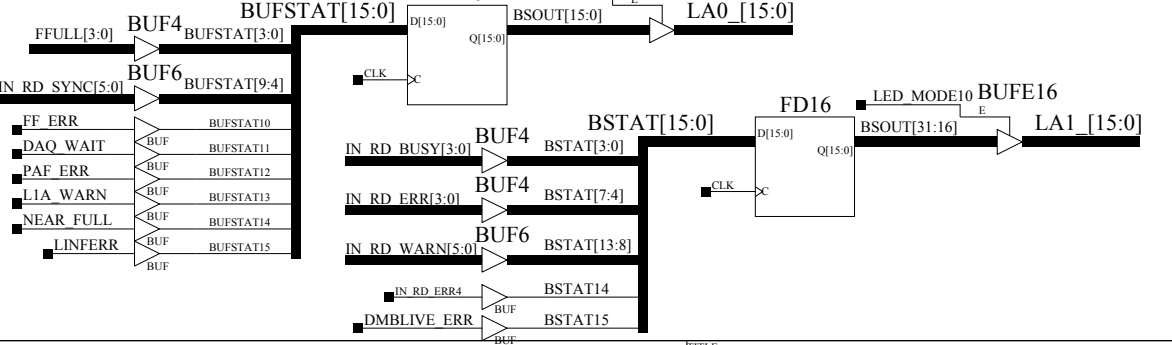
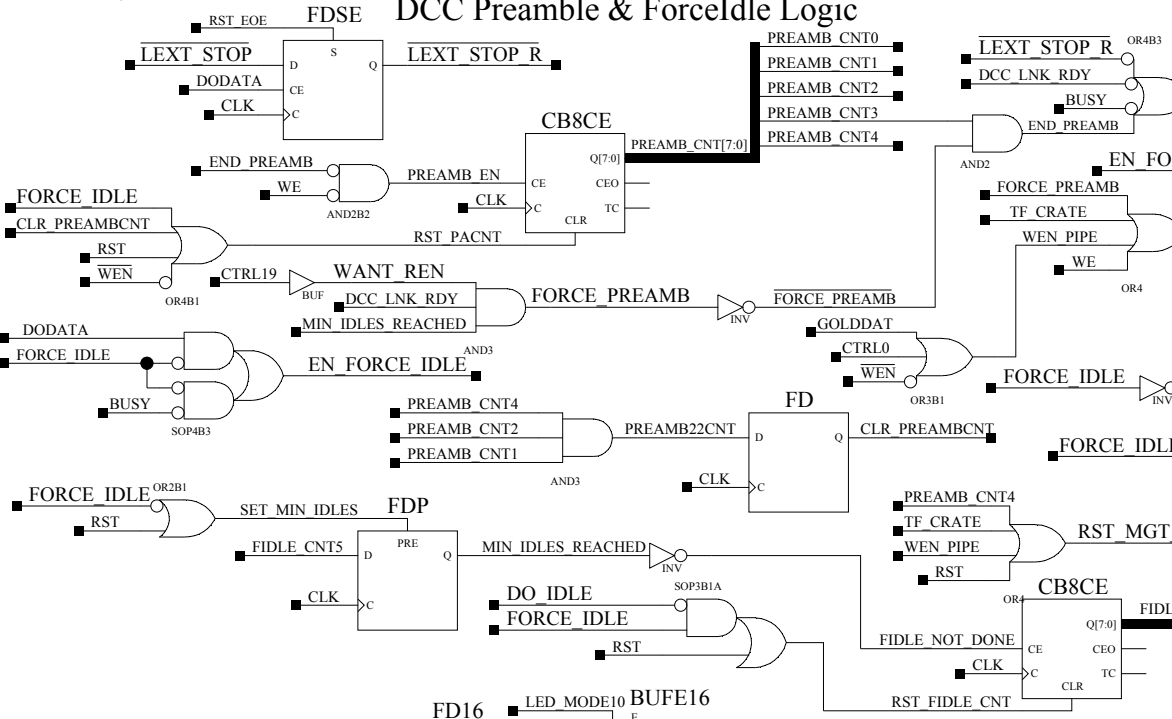
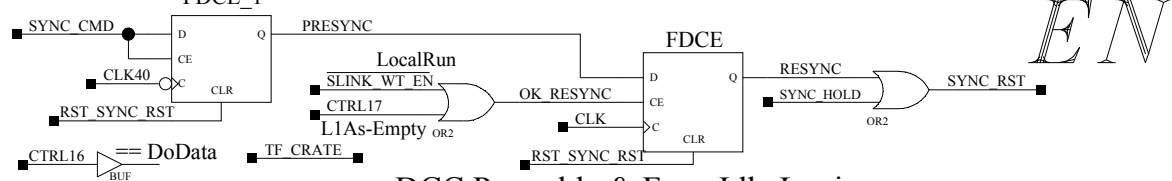
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Default States (during rst, prog & config)

DDU_BUSY = HI
 LD_RDY (vme3) = HI
 SENIN (sen5) = HI
 SEN6 (vme2) = HI
 TXEN[14:0] = HI (Low True)
 RDYIN[2:0] = HI (Low True)
 DCC_LinkRDY = HI (Low True)?
 DCC_StopDAT = HI (Low True)?
 FDPE

- DDU-FMM Error Condition definitions (in_rd_err4)
- 1) control word bit error OR filler added multiple times
 - 2) DMB fiber status change OR DMB Live register changed; InCtrl direct path to VME/FMM also used?
 - 3) DDU timeout for Control or InCtrl FPGA was set, NOT a detected DMB timeout
 - 4) extra/bad/missing Hdr/Tr word, Trg Trail or Lone word; DDU is lost due to corrupted data stream
 - 5) a specified CSC has TrgTrailErr/DAV-LCTerr/DMBtimeout detected
 - 6) extra data is stuck in a FIFO (InCtrl or on-board); maybe a Sync Error?
 - 7) was DDU_DLL_Err, but it's not really a "Reset Req'd" error...although it may cause problems
 -for now just set flag in data EOE for 1 event

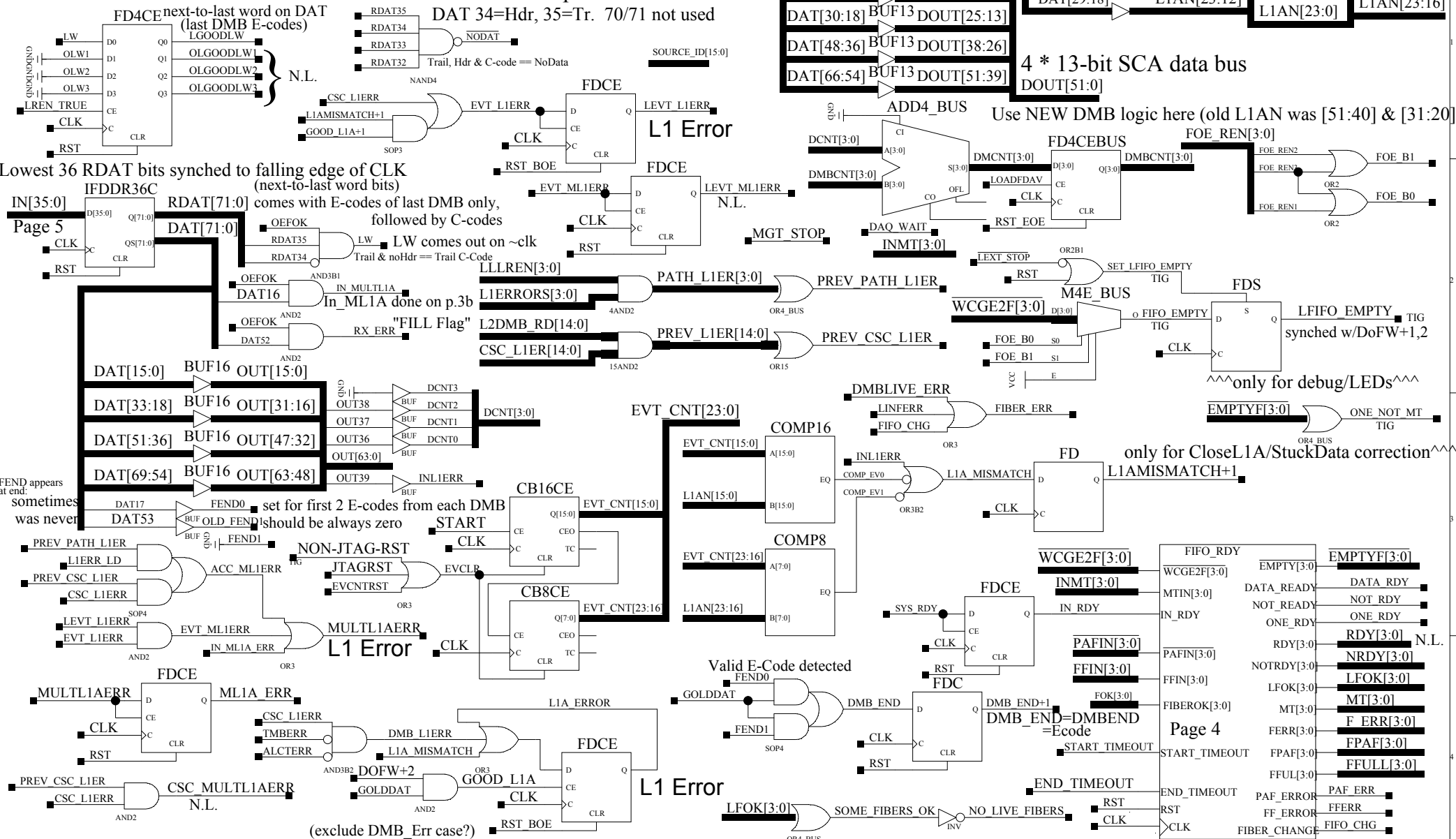
Logic for TFDDU, hold back the Resync until DDU completes all L1As (CTRL17) for Global runs. CTRL17 = DDU_Is_Empty
FDCE_1



From here on DAT16,53 are only used with C-Codes. But DAT17,52 are always DMBend, Filler. DAT70,71 are never used.

CLK^ -- DIN[35:0] -- CLKV -- Q[35:0] DIN[71:36] -- CLK^ -- Q[71:36] QS[35:0]

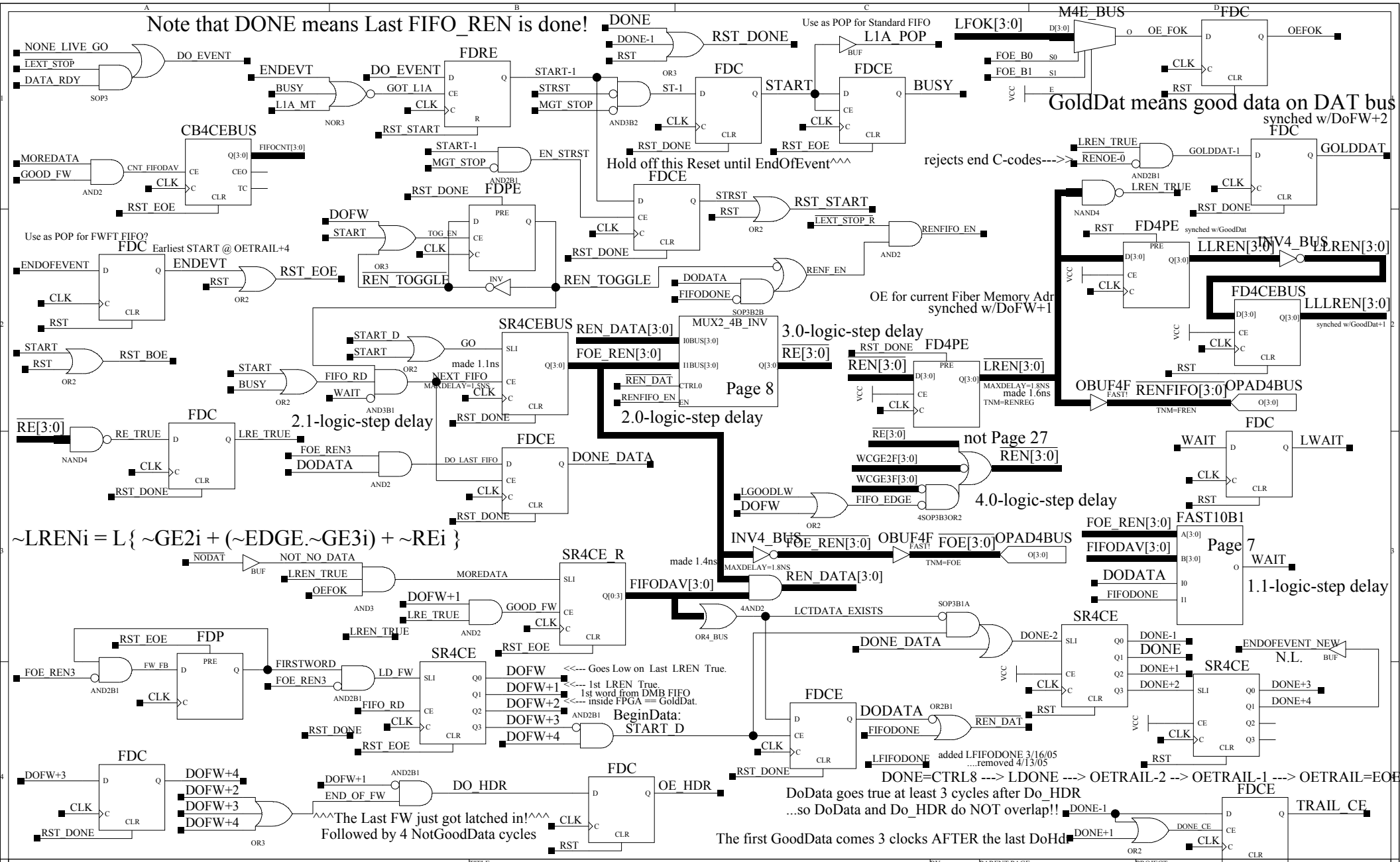
Use these busses for CFEB CRC and Special Word checks-->

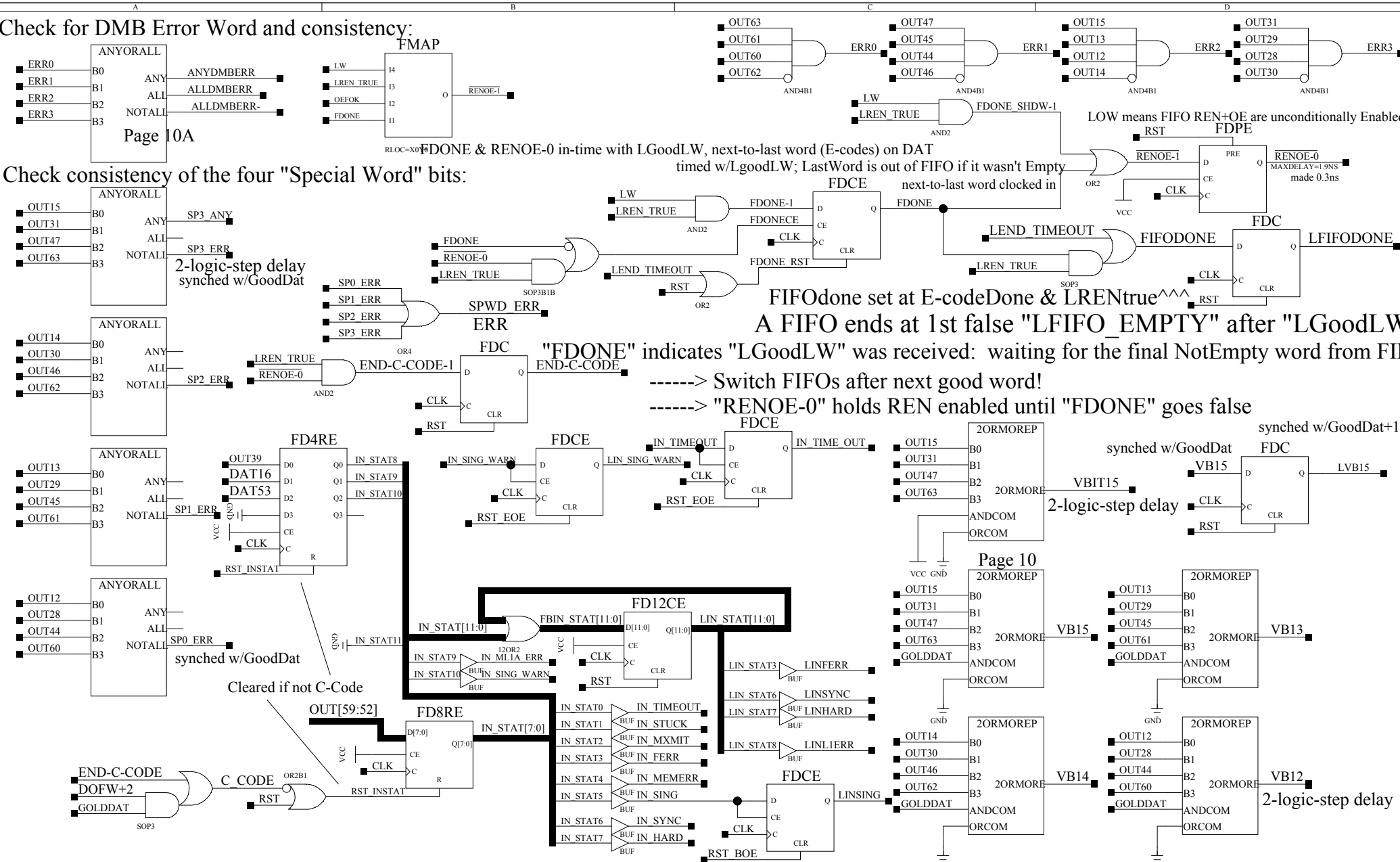


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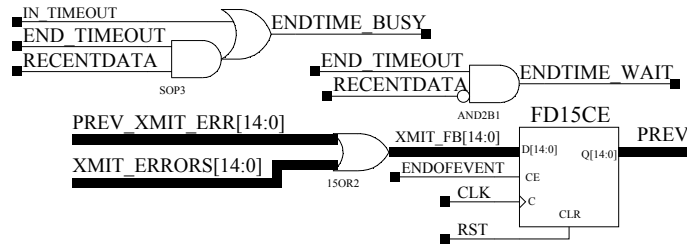
Note that DONE means Last FIFO_REN is done!



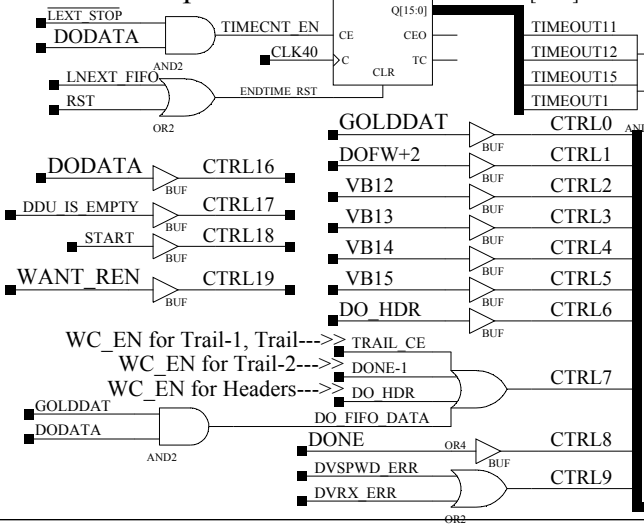


Control Bit List:

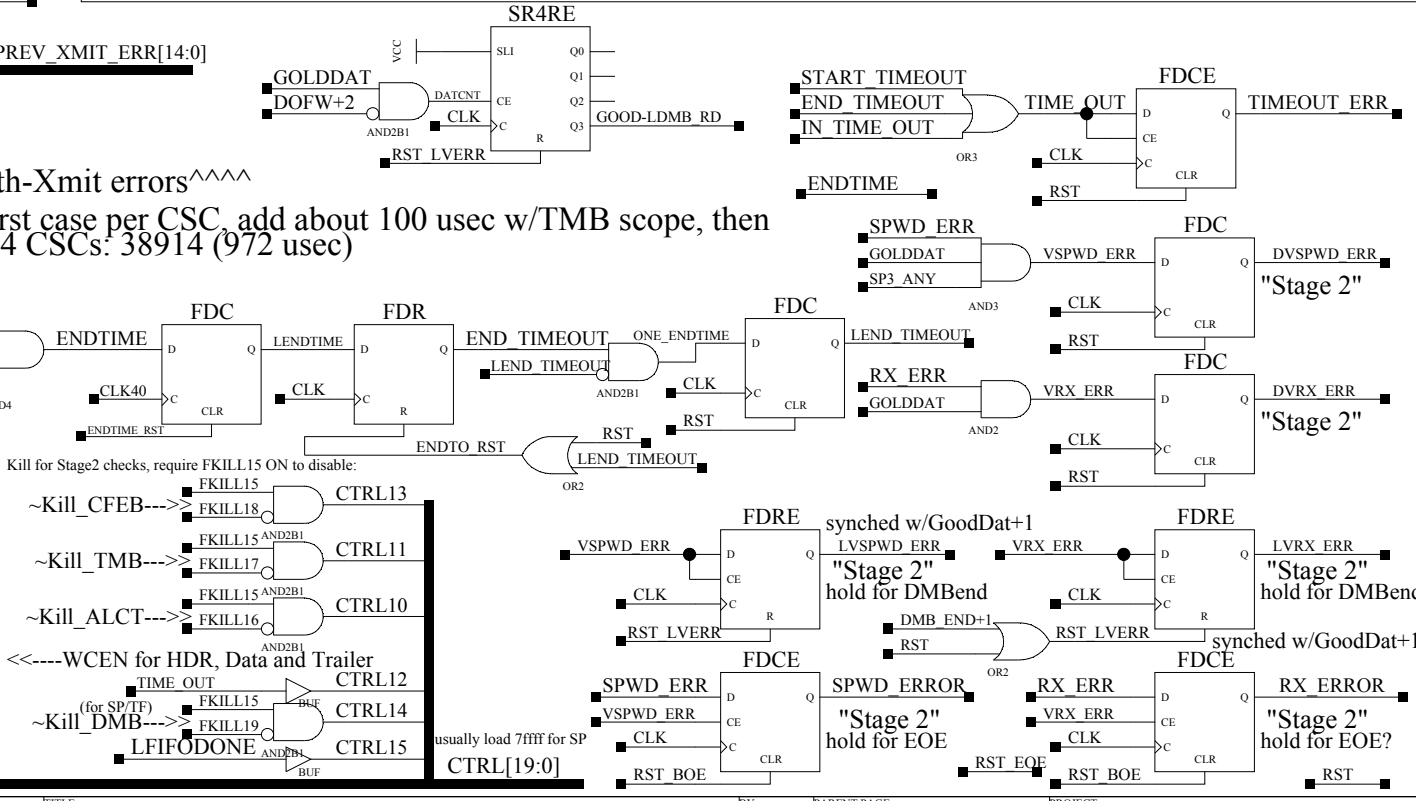
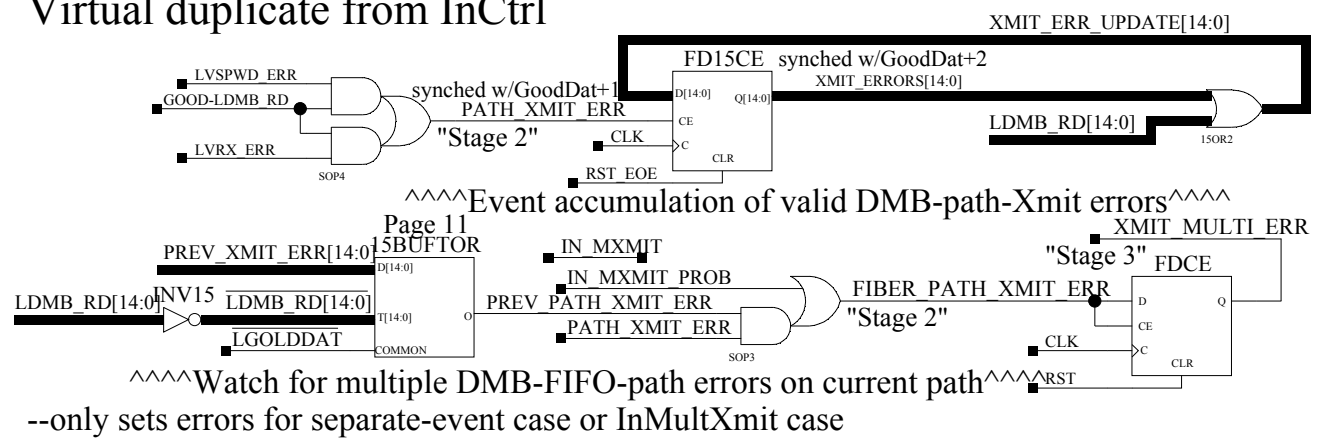
- 0: Gold Data (Active DMB has REN, OE, notMT, LFOK)
- 1: DMB First Word Mode
- 2: Latched Voted Special Bit 12 {2 or more out of 4}
- 3: Latched Voted Special Bit 13 {2 or more out of 4}
- 4: Latched Voted Special Bit 14 {2 or more out of 4}
- 5: Latched Voted Special Bit 15 {2 or more out of 4}
- 6: Do Header Mode (Header to Output)
- 7: Word Count Enable (DDU Header, DMB Data)
- 8: End of Event (DONE--->OETrail)



~~~~~Permanent accumulation of DMB-path-Xmit errors~~~~~  
FIFO Done Timeout: 132 usec=5281 is the worst case per CSC, add about 100 usec w/TMB scope, then 25ns clock period here  
another \*4 for 4 CSCs: 38914 (972 usec)



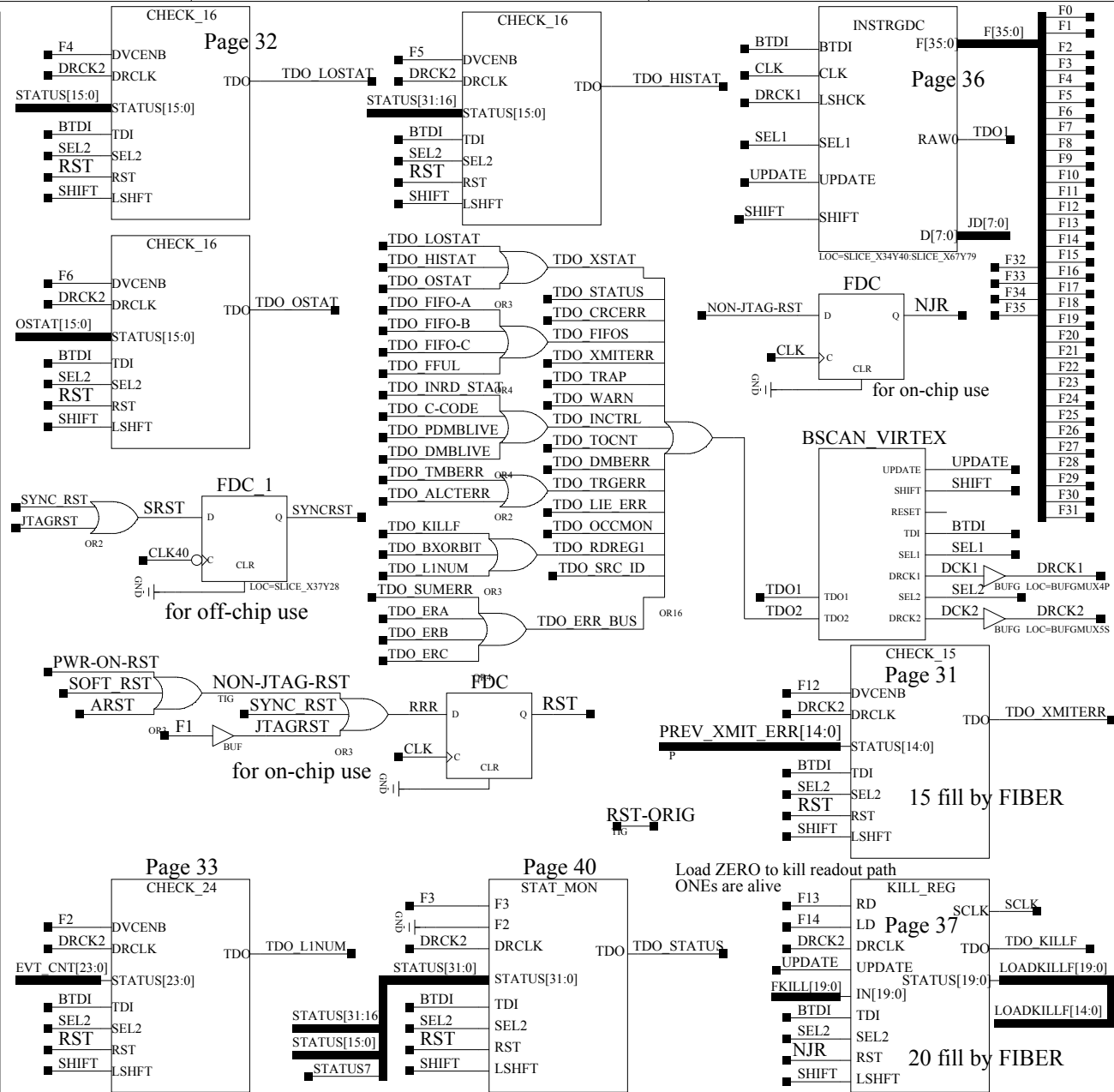
## Virtual duplicate from InCtrl

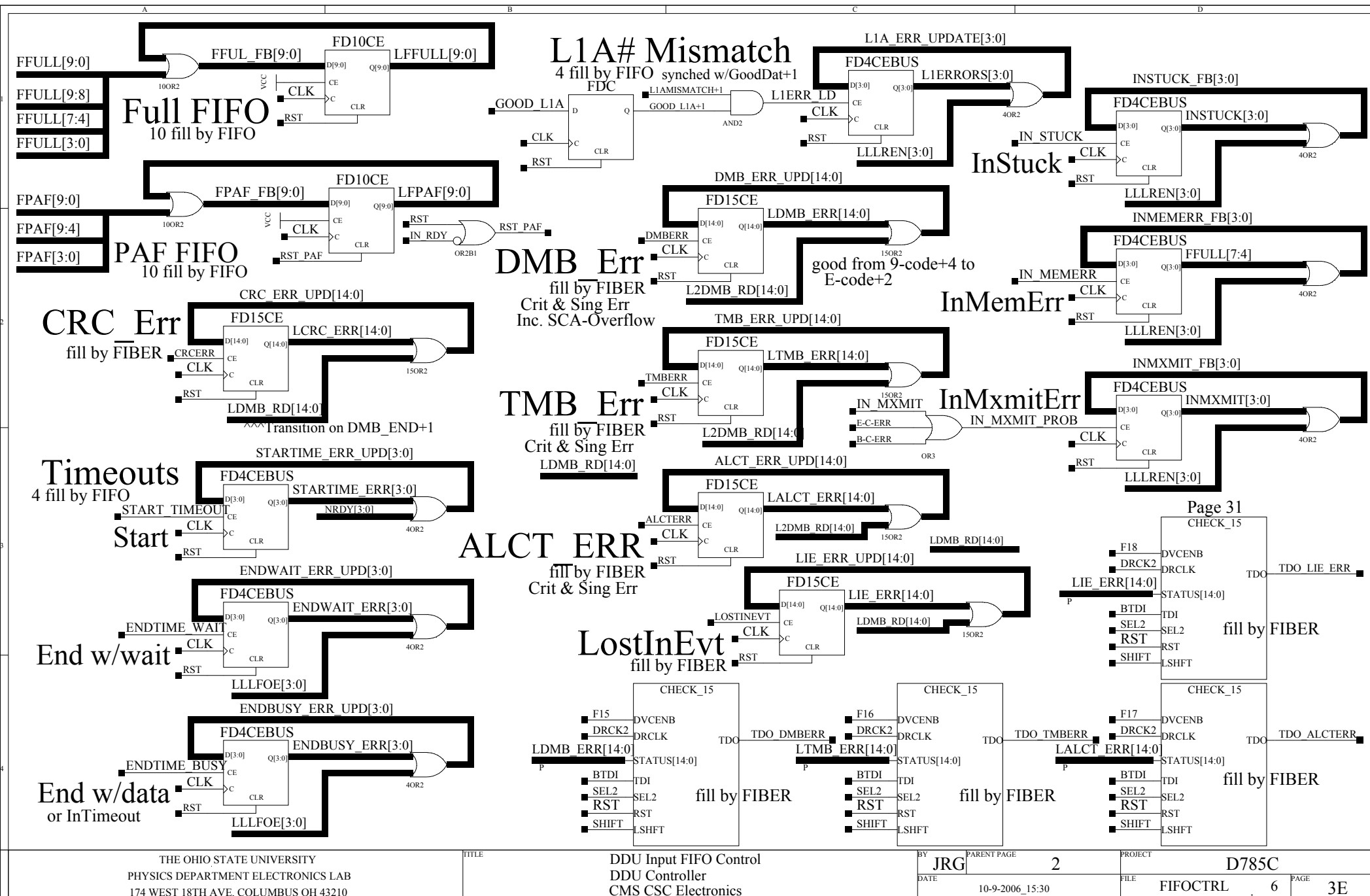


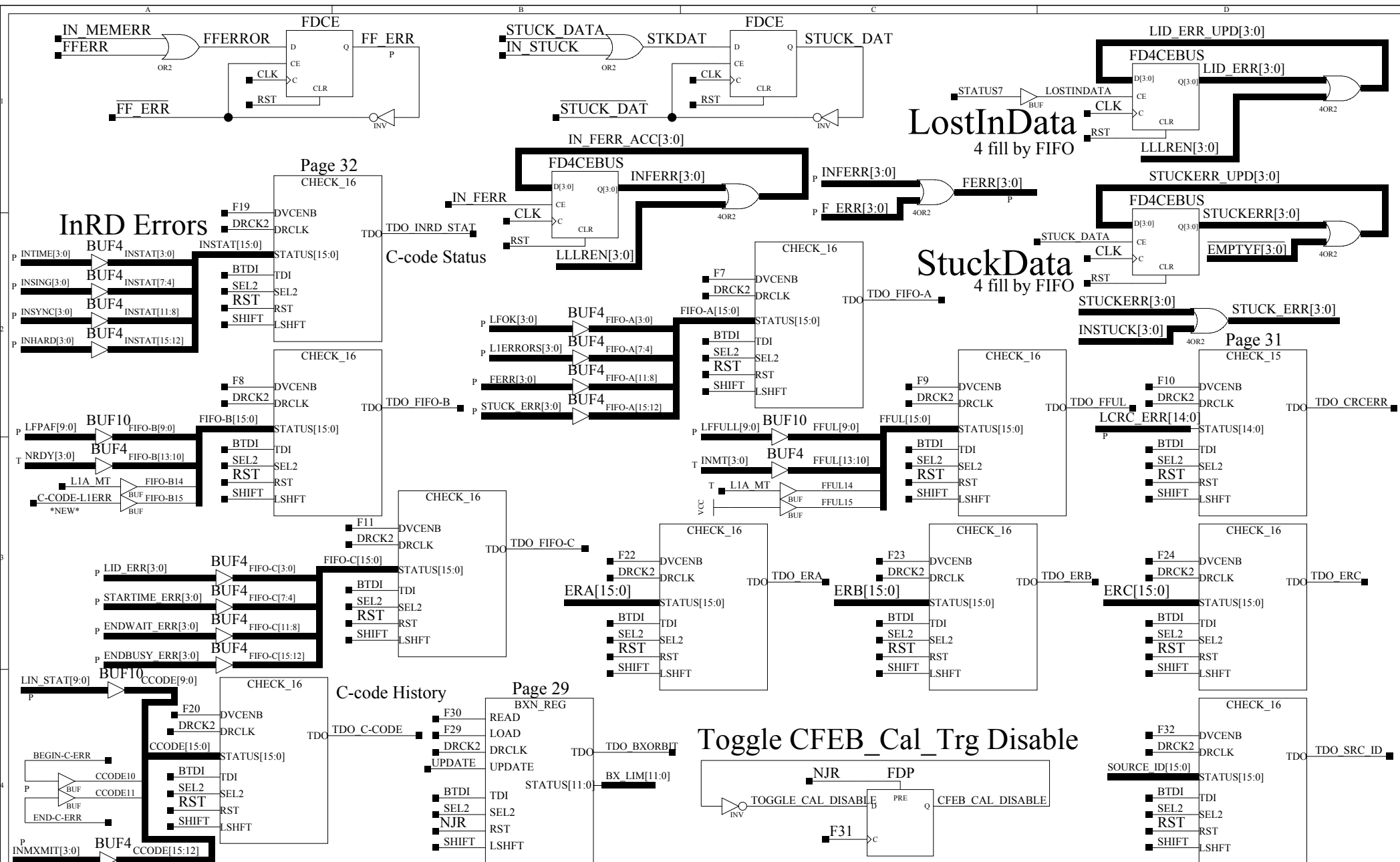


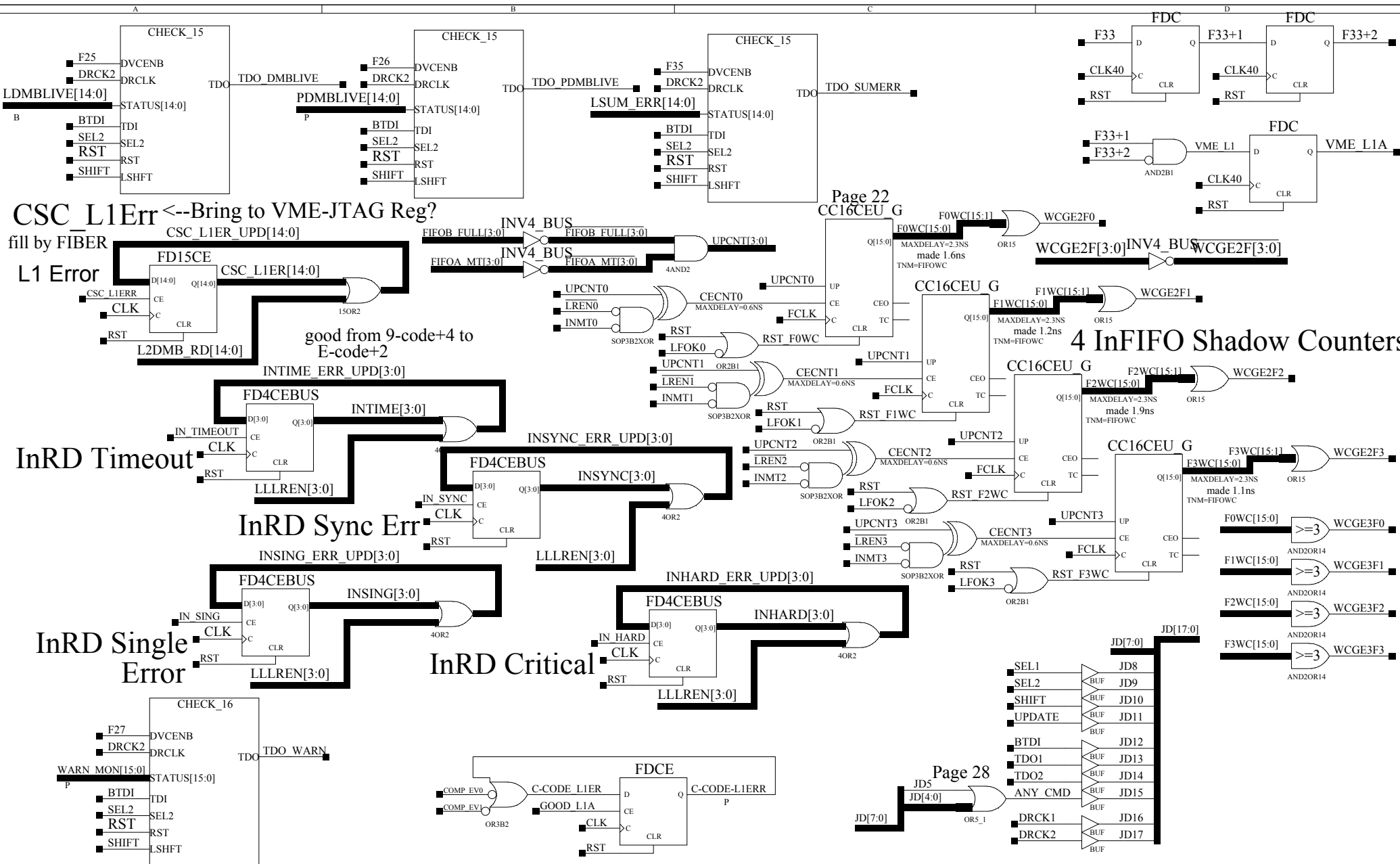
# JTAG Instruction Decode

| OpCode | Function                            | [OpName]                     |
|--------|-------------------------------------|------------------------------|
| 0      | No Operation                        | [NOOP]                       |
| 1      | FPGA Reset                          | [toggle]                     |
| 2      | Read Current DDU L1A Number         | [24-bit scaler]              |
| 3      | Check status (capture and shift)    | [32 bits]                    |
| 4      | Check status, low-word              | [16 bits]                    |
| 5      | Check status, high-word             | [16 bits]                    |
| 6      | Output Path Status                  | [16-bits]                    |
| 7a     | Check FOK (active input FIFOs)      | [lowest 4 bits]              |
| 7b     | L1A Mismatch (FIFO headers)         | [4-bits]                     |
| 7c     | Check FIFO Err (active FIFO change) | [4 bits]                     |
| 7d     | Stuck Data Errors (input FIFOs)     | [highest 4-bits]             |
| 8a     | Almost Full FIFOs                   | [lowest 10-bits]             |
| 8b     | FIFO Empty/GE2 Status               | [highest 6-bits]             |
| 9a     | Full FIFOs                          | [lowest 10-bits]             |
| * 9b   | Raw FIFO Empty                      | [highest 6-bits]             |
| 10     | CRC Errors                          | [15-bits]                    |
| 11a    | Lost In Data                        | [lowest 4-bits]              |
| 11b    | Timeout: start                      | [4-bits]                     |
| 11c    | Timeout: end-wait                   | [4-bits]                     |
| 11d    | Timeout: end-active                 | [highest 4-bits]             |
| 12     | Data Xmit Errors                    | [15-bits]                    |
| 13     | Check KILL_Register                 | [20 bits]                    |
| 14     | Load KILL_Register                  | [20 bits]                    |
| 15     | DMB Errors                          | [15-bits]                    |
| 16     | TMB Errors                          | [15-bits]                    |
| 17     | ALCT Errors                         | [15-bits]                    |
| 18     | Lost In Event                       | [15-bits]                    |
| * 19   | InRD Status                         | [16-bits]                    |
| * 20   | InRD C-code & MxmitErr History      | [16-bits]                    |
| * 21   | Critical Error Trap Reg.            | [192 bits]                   |
| 22     | Error Register A                    | [16-bits]                    |
| 23     | Error Register B                    | [16-bits]                    |
| 24     | Error Register C                    | [16-bits]                    |
| 25     | Read DMB_LIVE                       | [15-bits]                    |
| 26     | Read P_DMB_LIVE                     | [15-bits]                    |
| 27     | Read WARN_MON                       | [16-bits]                    |
| * 28   | Max Timeout Count                   | [16-bits]                    |
| 29     | Set BX per Orbit                    | [12-bits]                    |
| 30     | Read BX per Orbit                   | [12-bits]                    |
| 31     | Toggle CFEb_Cal Auto_L1             | [default enable]             |
| 32     | Read DDU Source ID                  | [16-bits]                    |
| 33     | DDU-only VME_L1A                    |                              |
| * 34   | Read CSC Board Occupancy scalers    | (loops for 60 words, 32-bit) |
| 35     | Sum of Errors for each CSC          | [15-bits]                    |



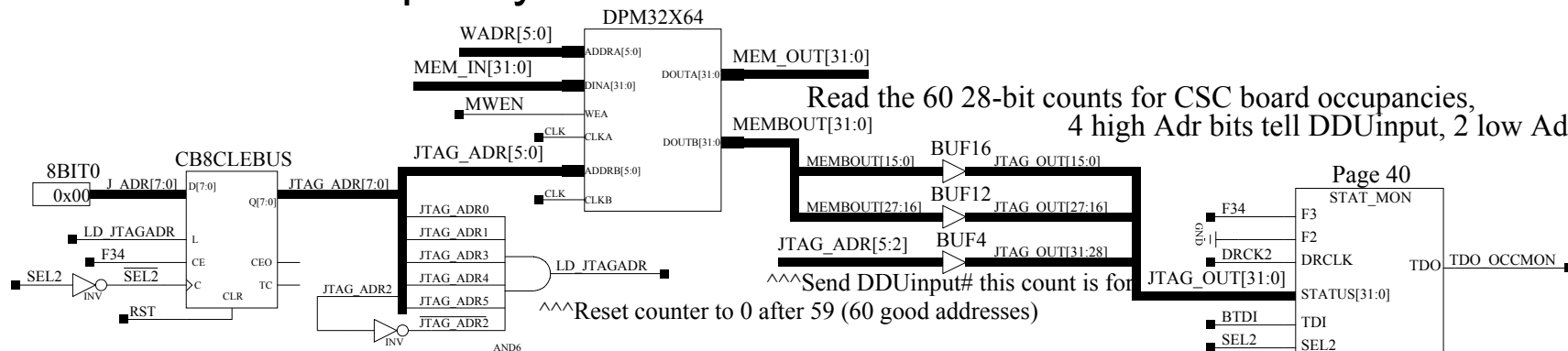






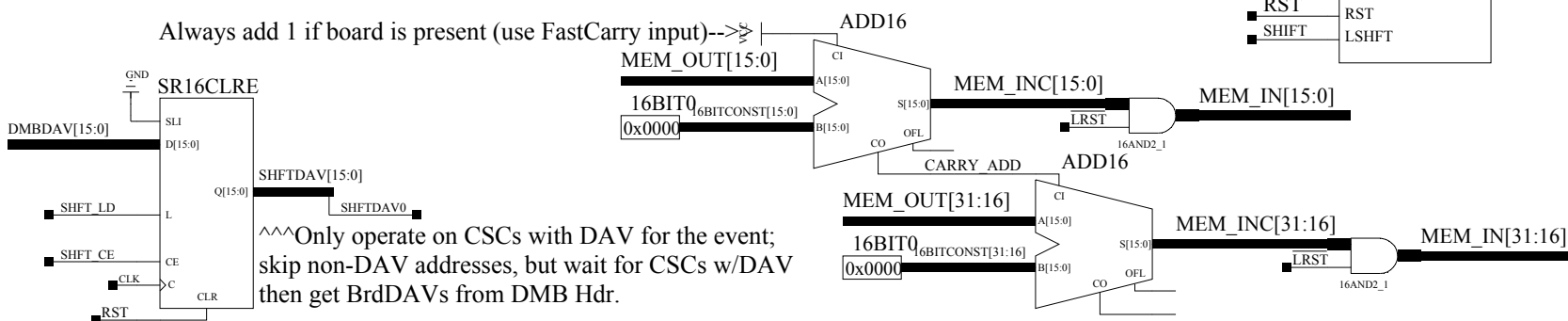


## CSC Board Occupancy Tracker: 15 fibers x 4-boards each



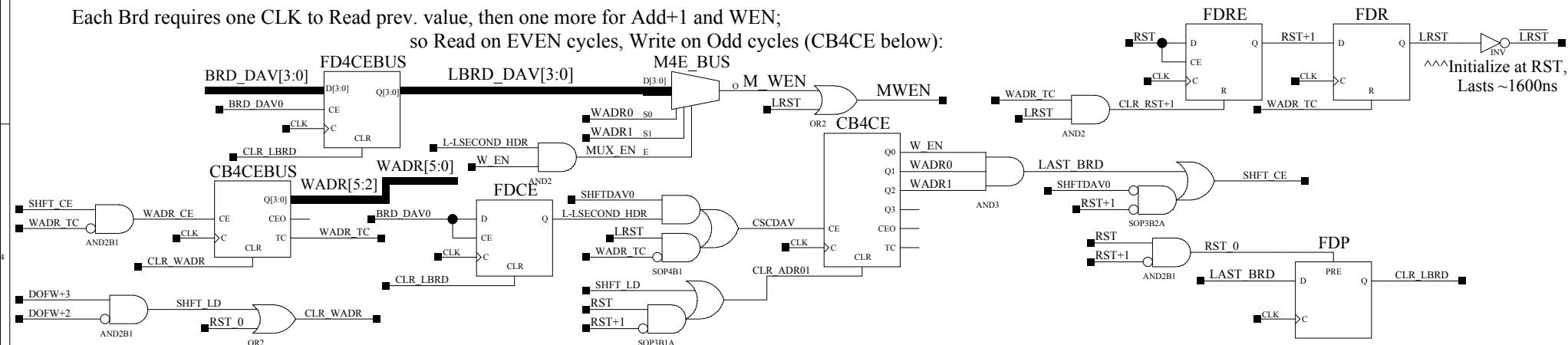
0 = DMB  
1 = ALCT  
2 = TMB  
3 = CFEB

Always add 1 if board is present (use FastCarry input)-->



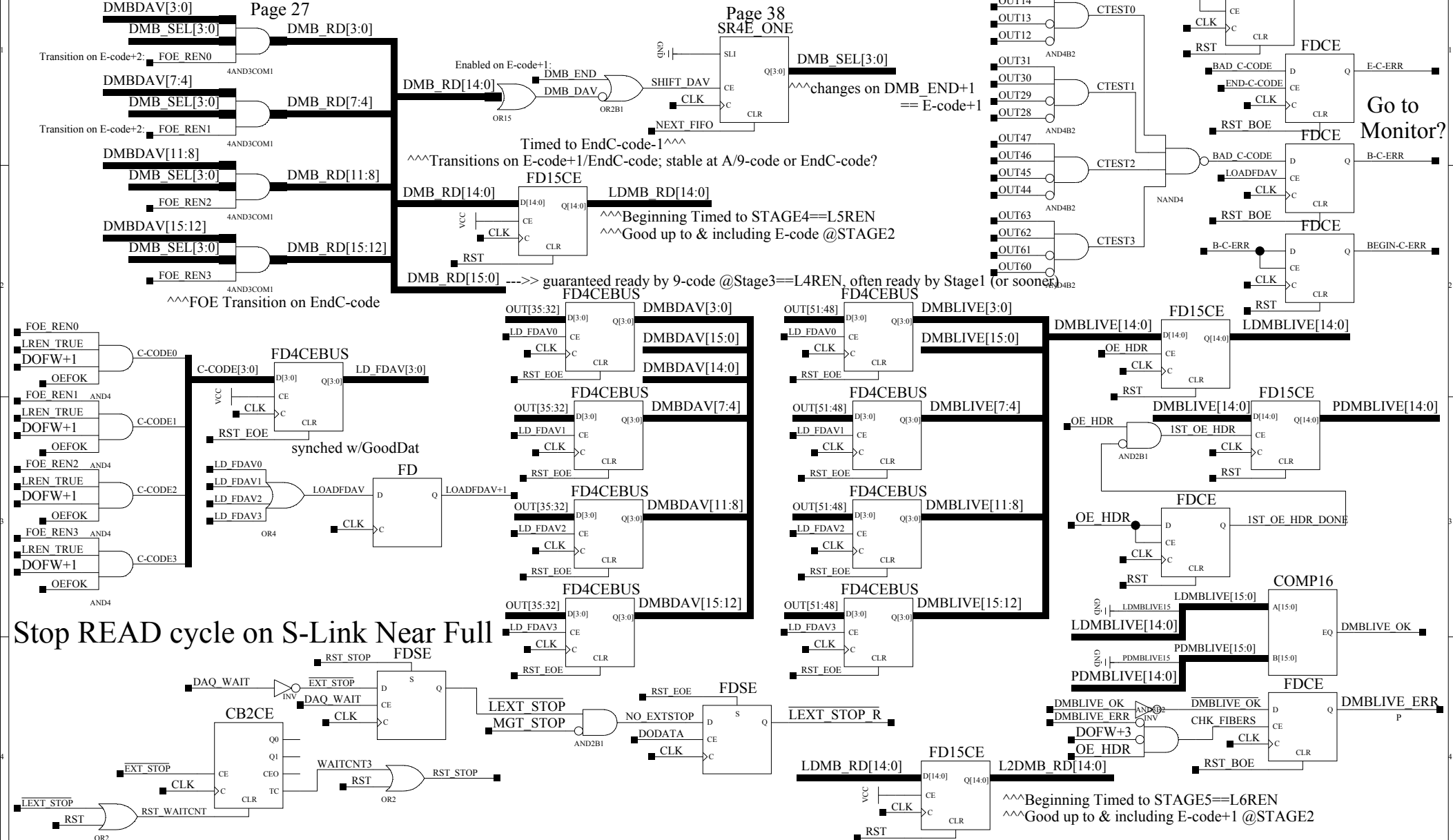
^^^Only operate on CSCs with DAV for the event;  
skip non-DAV addresses, but wait for CSCs w/DAV  
then get BrdDAVs from DMB Hdr.

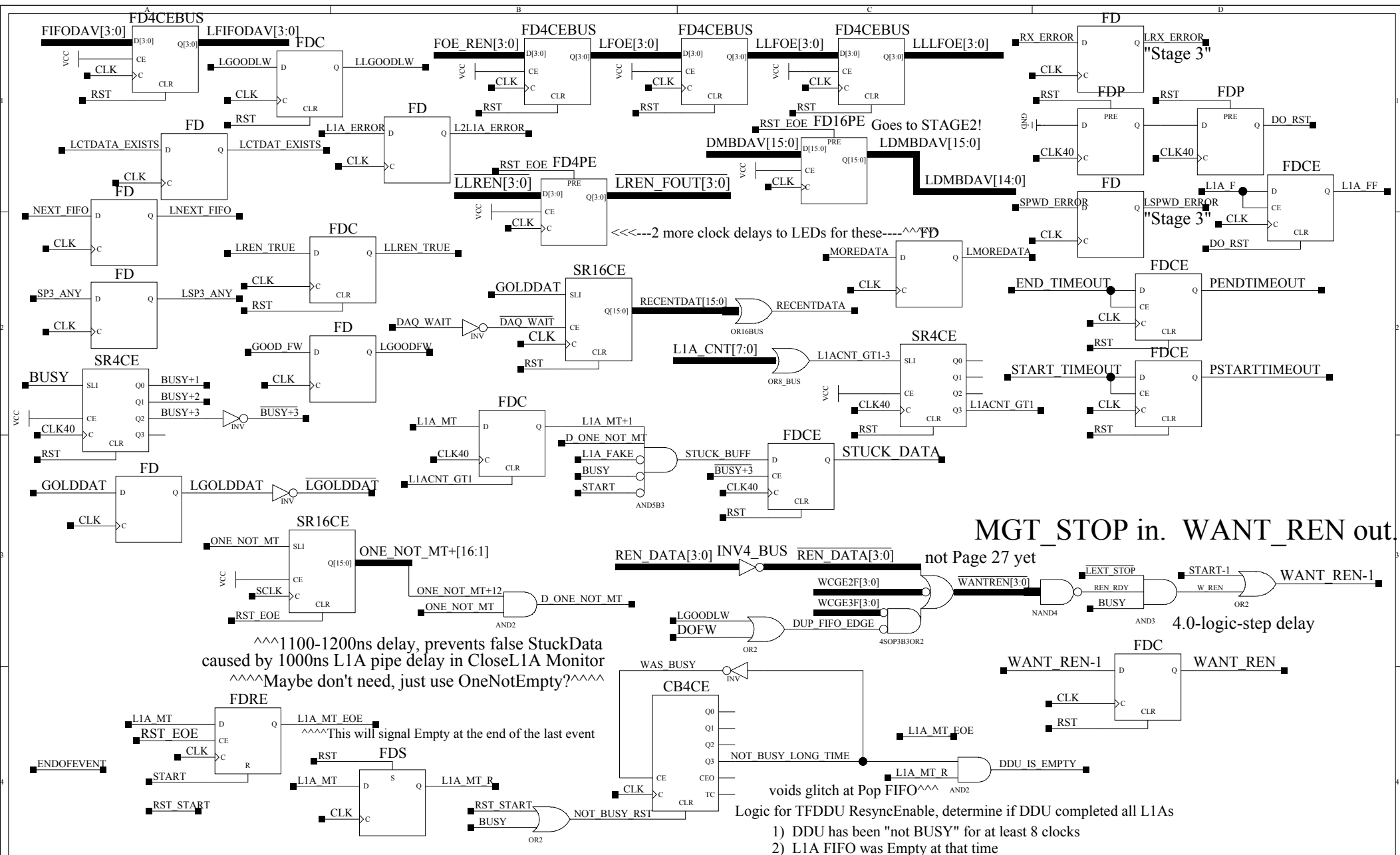
Each Brd requires one CLK to Read prev. value, then one more for Add+1 and WEN;  
so Read on EVEN cycles, Write on Odd cycles (CB4CE below):



^^^Initialize at RST,  
Lasts ~1600ns

Use DMB\_RD to determine which FIBER we're currently reading



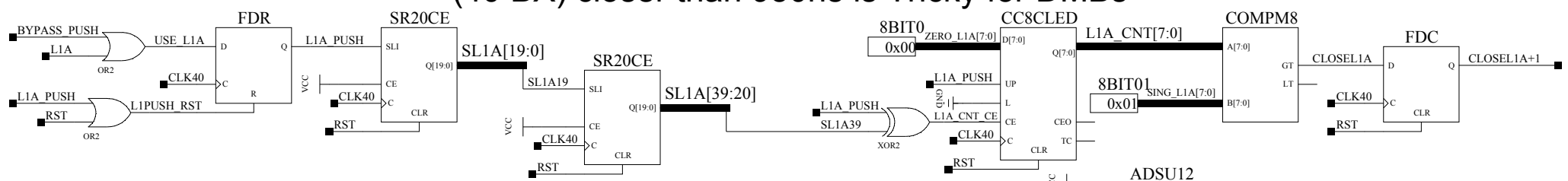




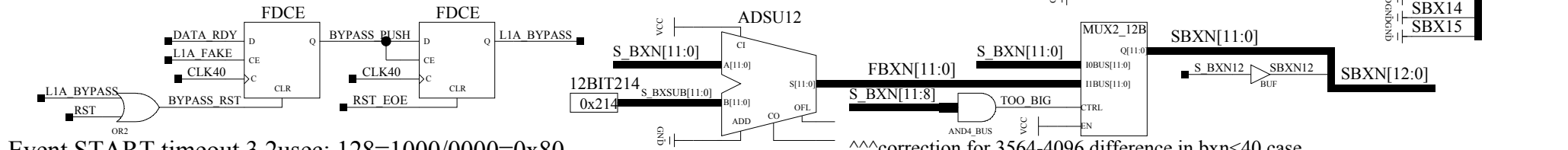
END

# L1A Proximity Tracker: 1000ns Close L1A Monitor

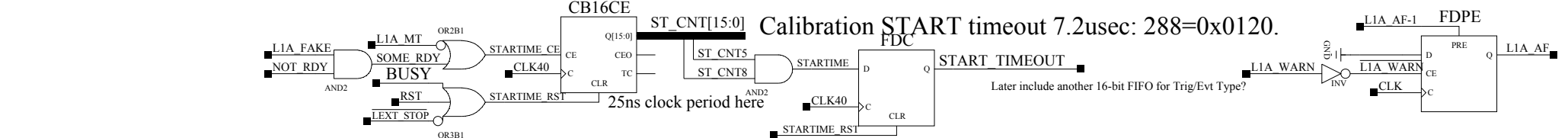
## (40 BX) closer than 950ns is Tricky for DMBs



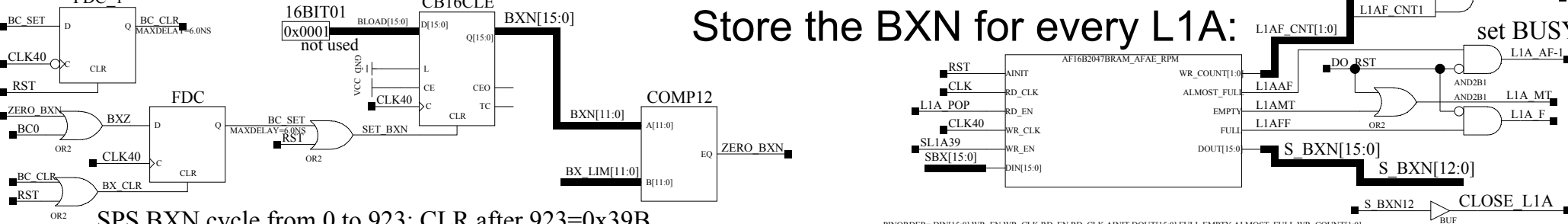
Pipe all L1As for 1000ns, if more than 1 then set CloseL1A bit^^  
 Finally, perform BX-40 to correct BXN and store CloseL1A as BXN bit-12 (& correct for BX<40 case).  
 Then use SBXN12 output (Close\_L1A ) for Stage2 DMB checks: 1000+ ns L1As means  
 that first 2 CFEB samples should always have good L1A#

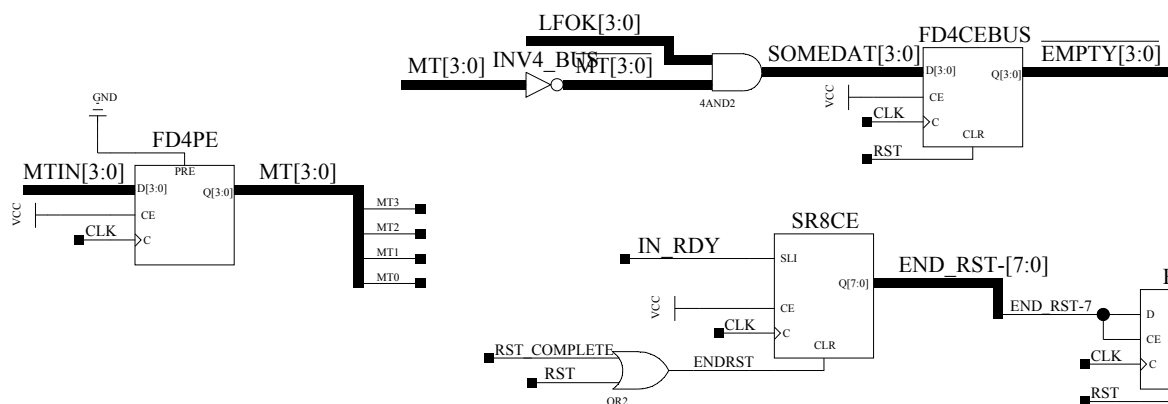


Event START timeout 3.2usec:  $128=1000/0000=0x80....$  ^^correction for 3564-4096 difference in bxn<40 case

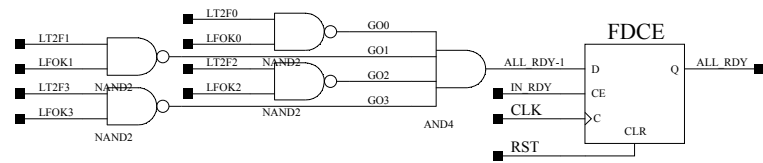
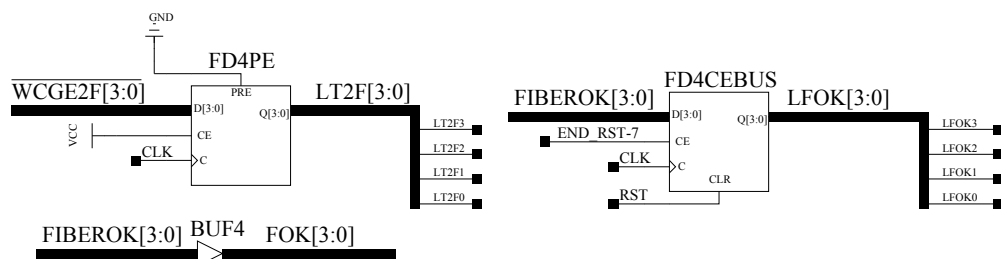
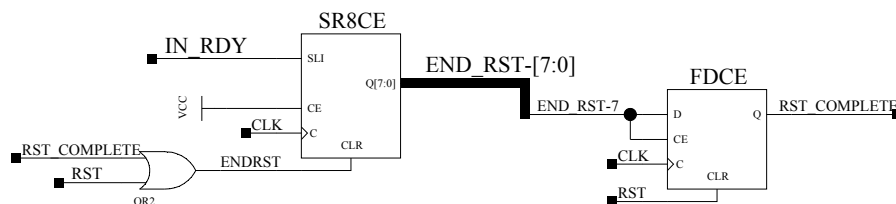


LHC BXN cycles from 0 to 3563  
 Set to BX=0 one cycle after BX LIM:  $3563=1101/1110/1011=0xDEB$   
 Calibration START timeout 7.2usec:  $288=0x0120$ .

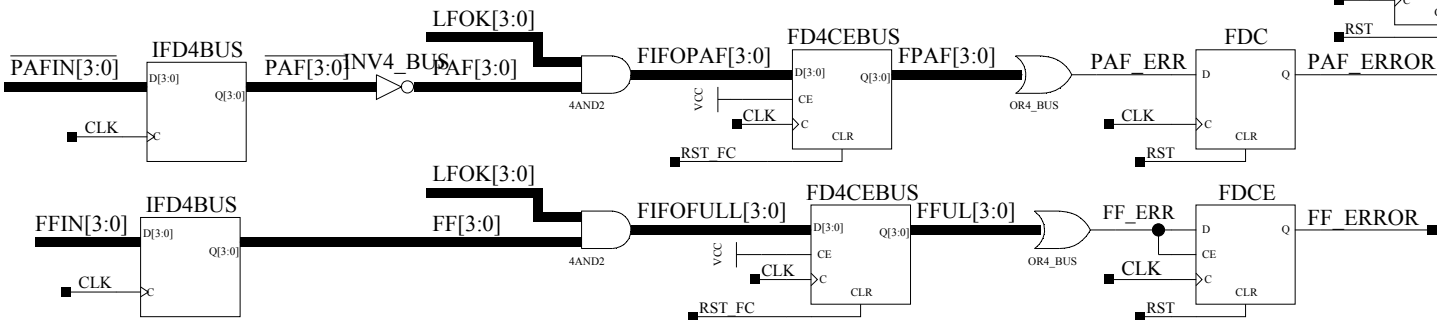
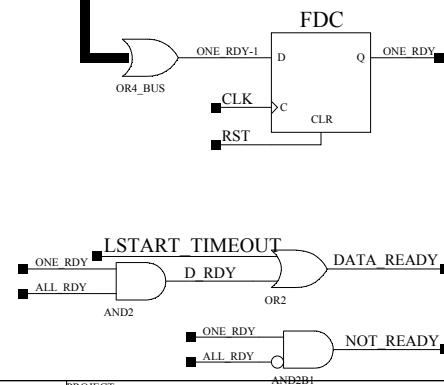
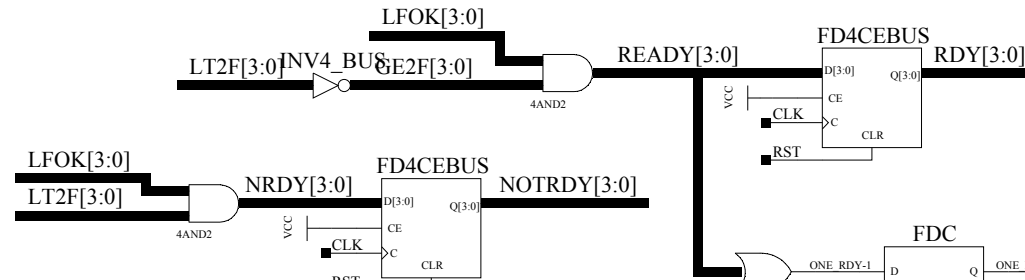


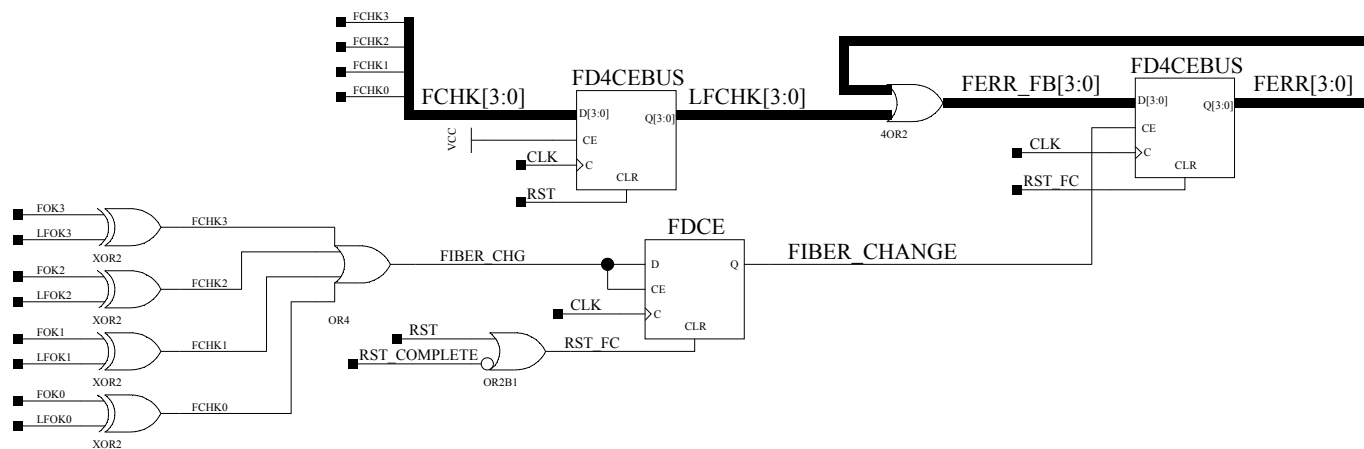


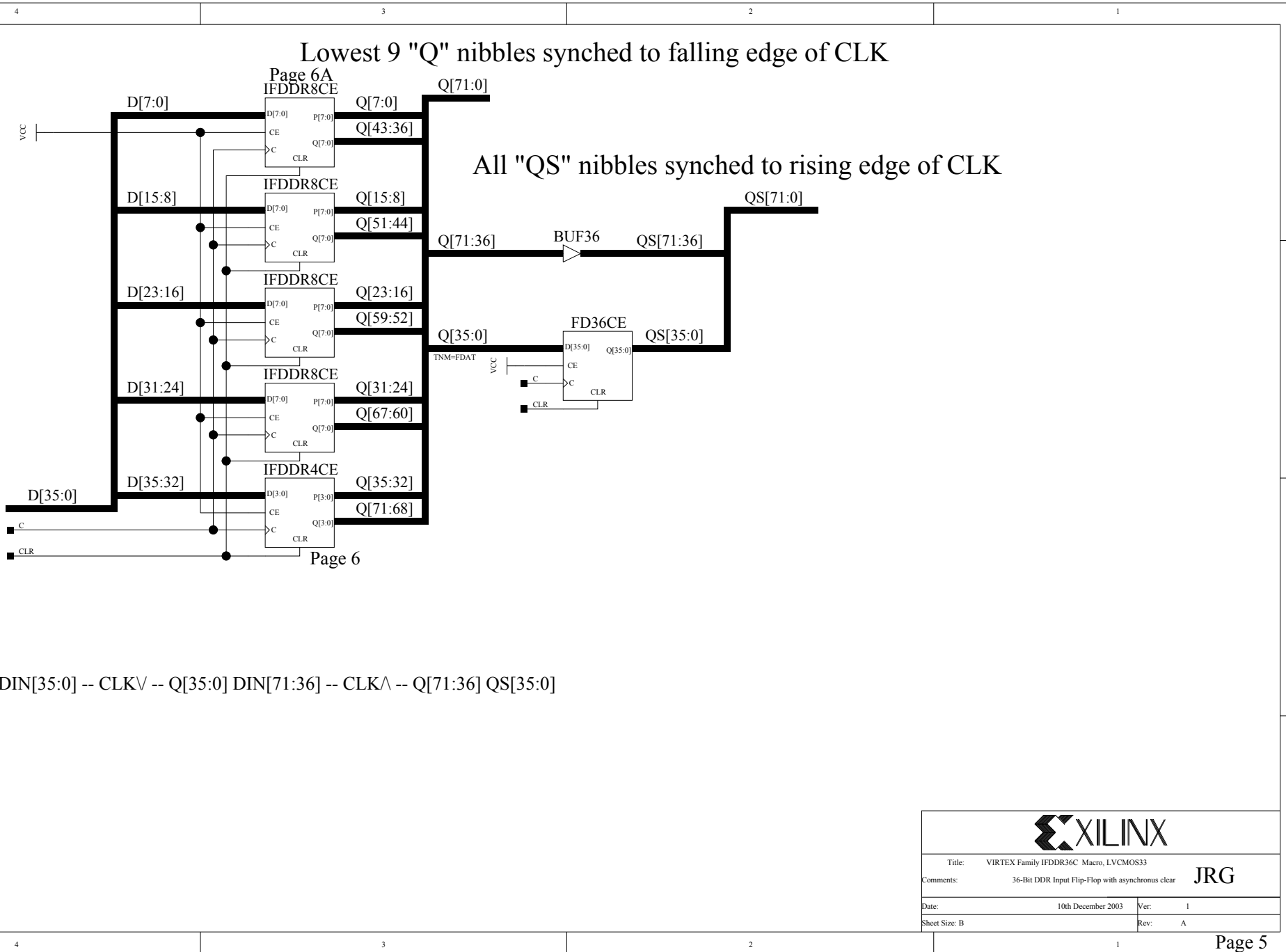
Access FIBEROK from JTAG as a fiber check.  
 ---> RESET required after fiber status change for now...  
 Change in FIBEROK is BAD! Set error code.  
 ...notify FMM and maybe set STATUS bit, but  
 ...data is OK until FIFO read time-out occurs.  
 ...but how to know WHEN the bad-data comes out?  
 ---> timeout will probably occur for that event

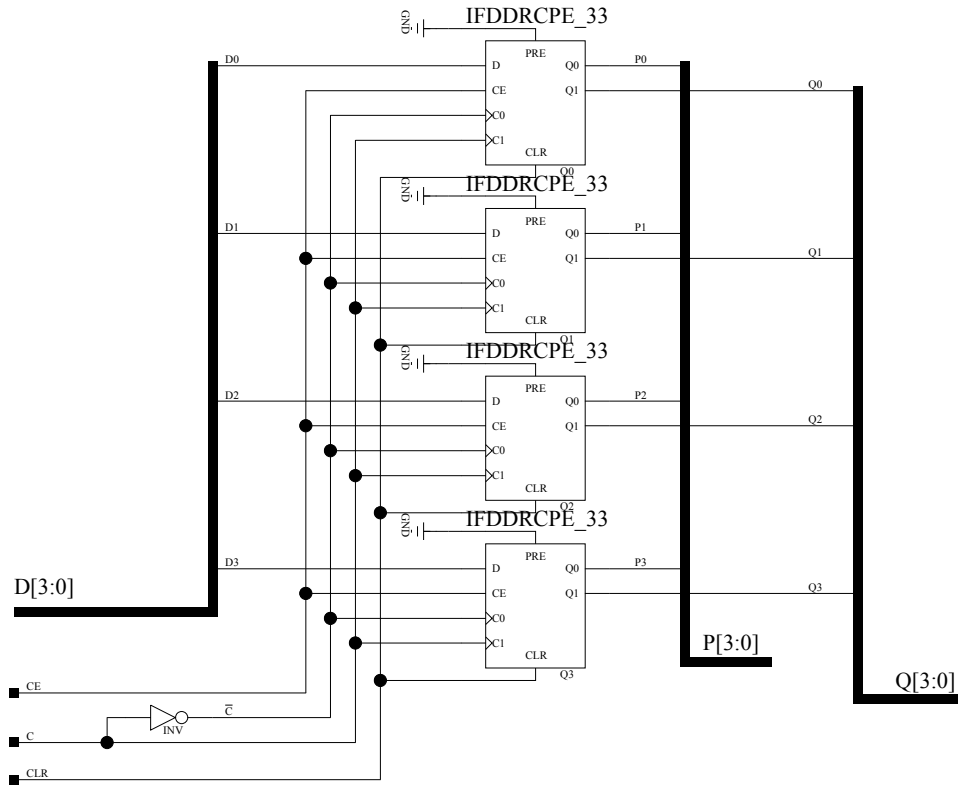


MASK fiber on Start/End TIMEOUT? Kill it in LFOK...



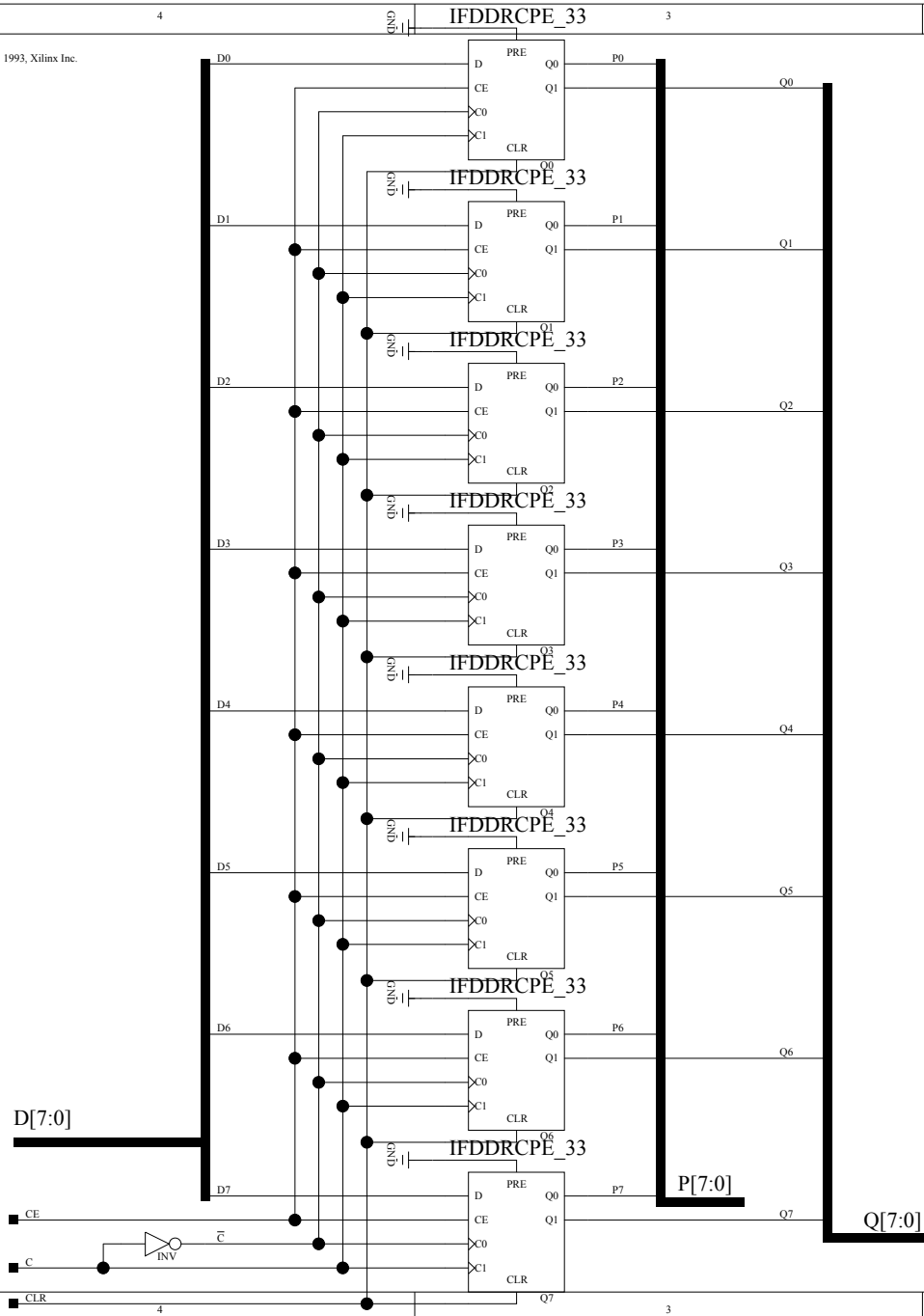




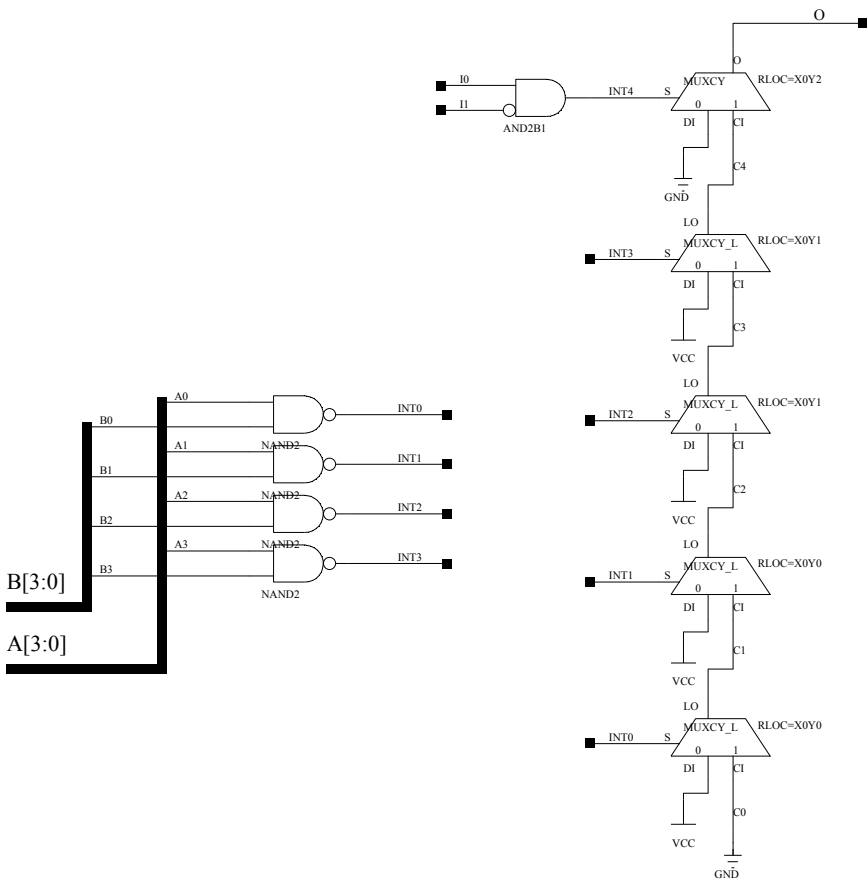


|               |                                                                             |      |     |
|---------------|-----------------------------------------------------------------------------|------|-----|
| Title:        | VIRTEX Family IFDDR4CE Macro, LVC MOS33                                     |      | JRG |
| Comments:     | 4-Bit Double-Data-Rate Input Register w/<br>Clock Enable & Asynchronous Clr |      |     |
| Date:         | 10th December 2003                                                          | Ver: | 1   |
| Sheet Size: B |                                                                             | Rev: | A   |

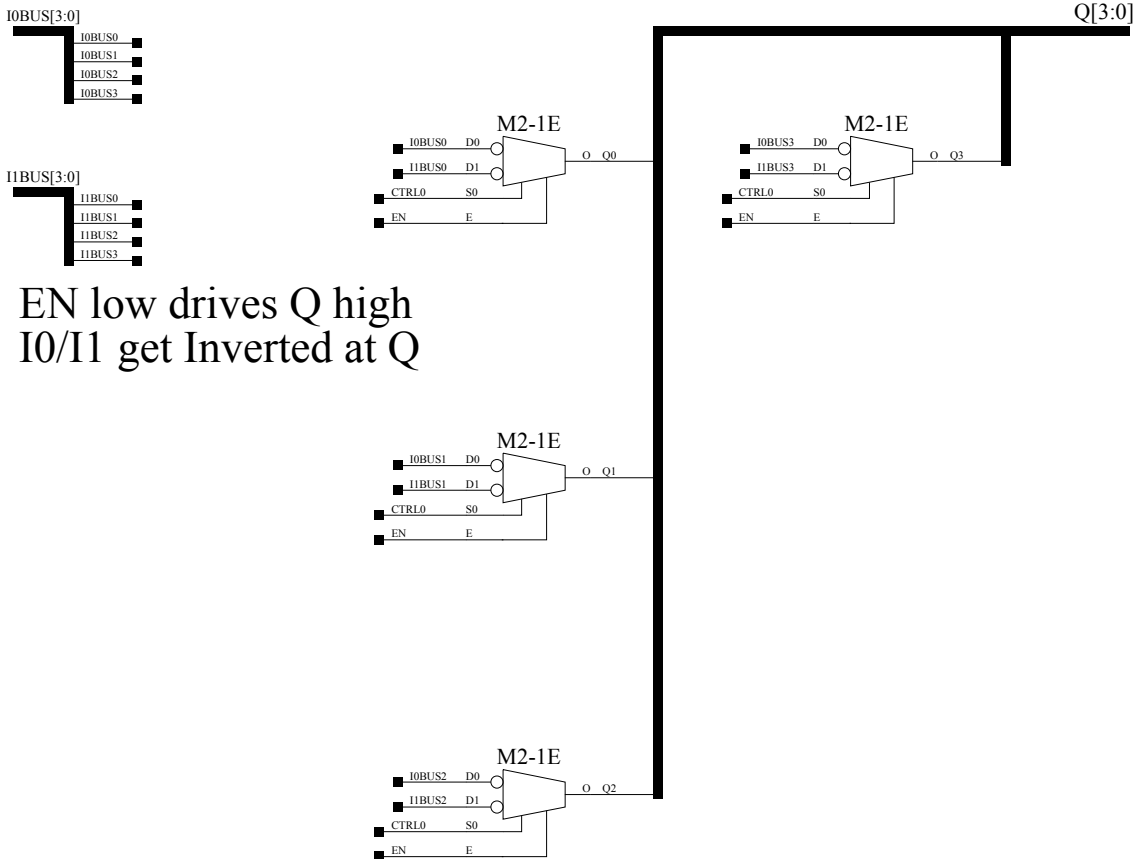
drawn by KS  
Copyright (c) 1993, Xilinx Inc.



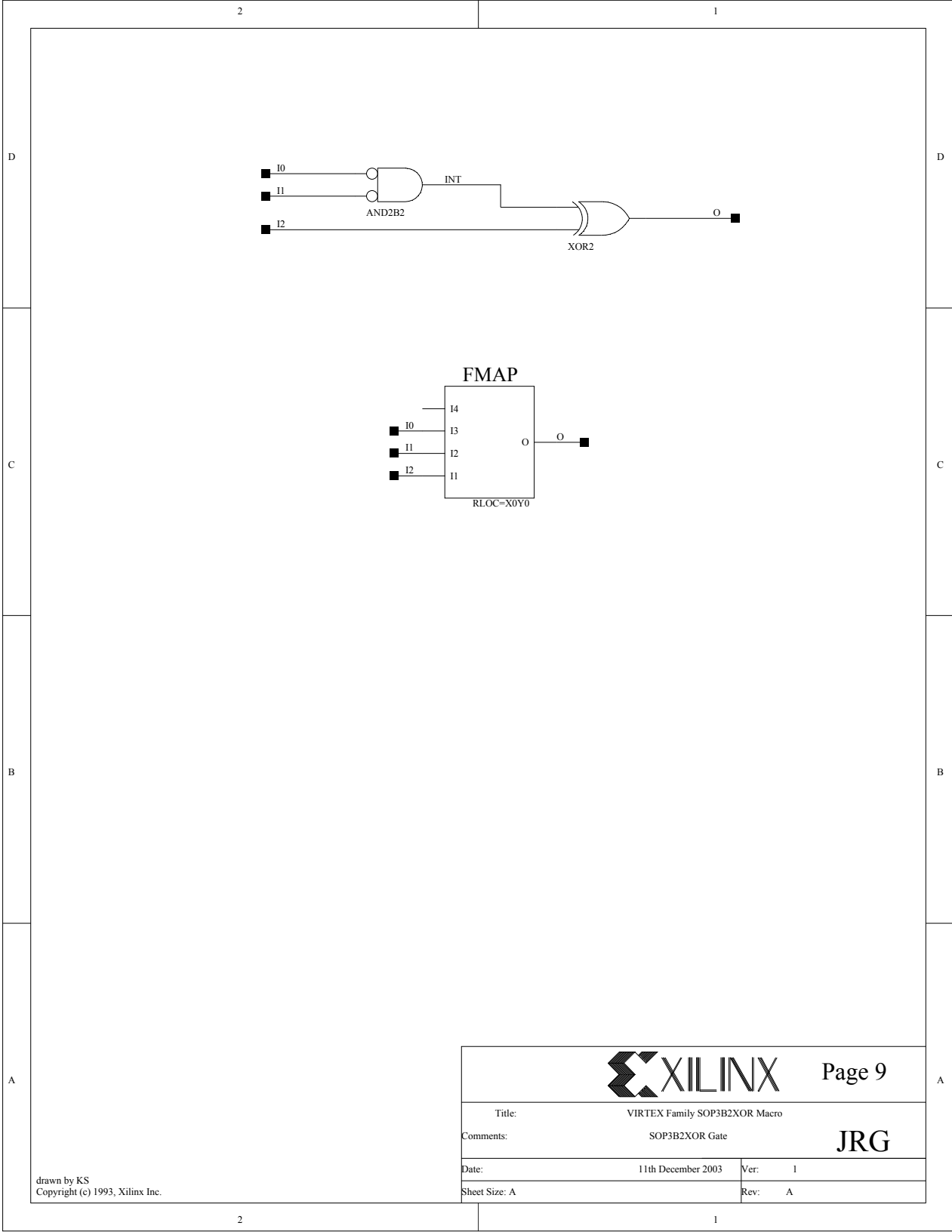
|               |                                                                             |        |
|---------------|-----------------------------------------------------------------------------|--------|
| Title:        | VIRTEX Family IFDDR8SCE Macro, LVCMOS33                                     |        |
| Comments:     | 8-Bit Double-Data-Rate Input Register w/<br>Clock Enable & Asynchronous Clr |        |
| Date:         | 10th December 2003                                                          | Ver: 1 |
| Sheet Size: B |                                                                             | Rev: A |

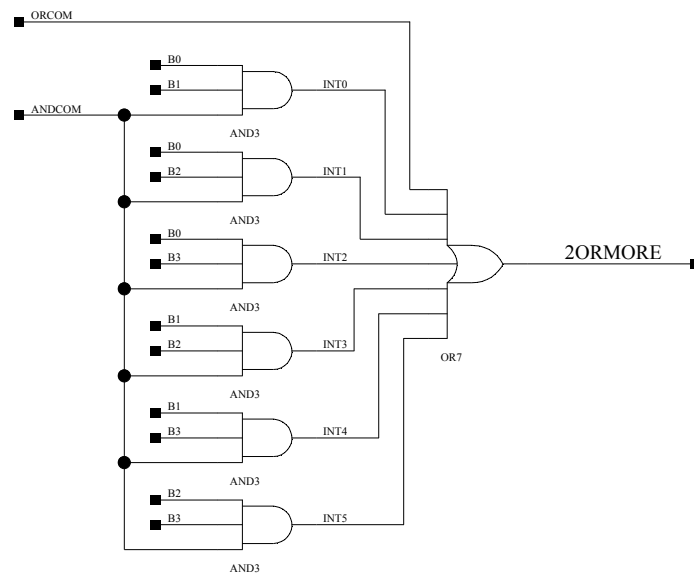


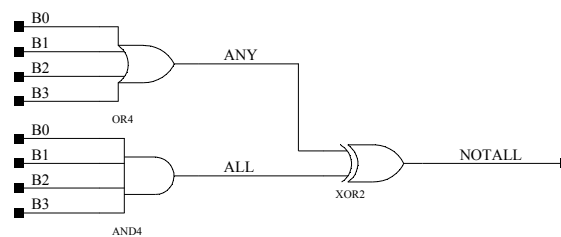
|                                                                                       |                   |                                                                                                     |   |
|---------------------------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------|---|
|  |                   | JRG                                                                                                 |   |
| Title:                                                                                |                   | FAST10B1                                                                                            |   |
| Comments:                                                                             |                   | Custom Fast, Complex Logic for DDU, use 4 MUXCY as OR, 1 as AND similar to: OR of 4 AND2 AND AND2B1 |   |
| Date:                                                                                 | 15th October 2003 | Ver:                                                                                                | 1 |
| Sheet Size:                                                                           | B                 | Rev:                                                                                                | A |

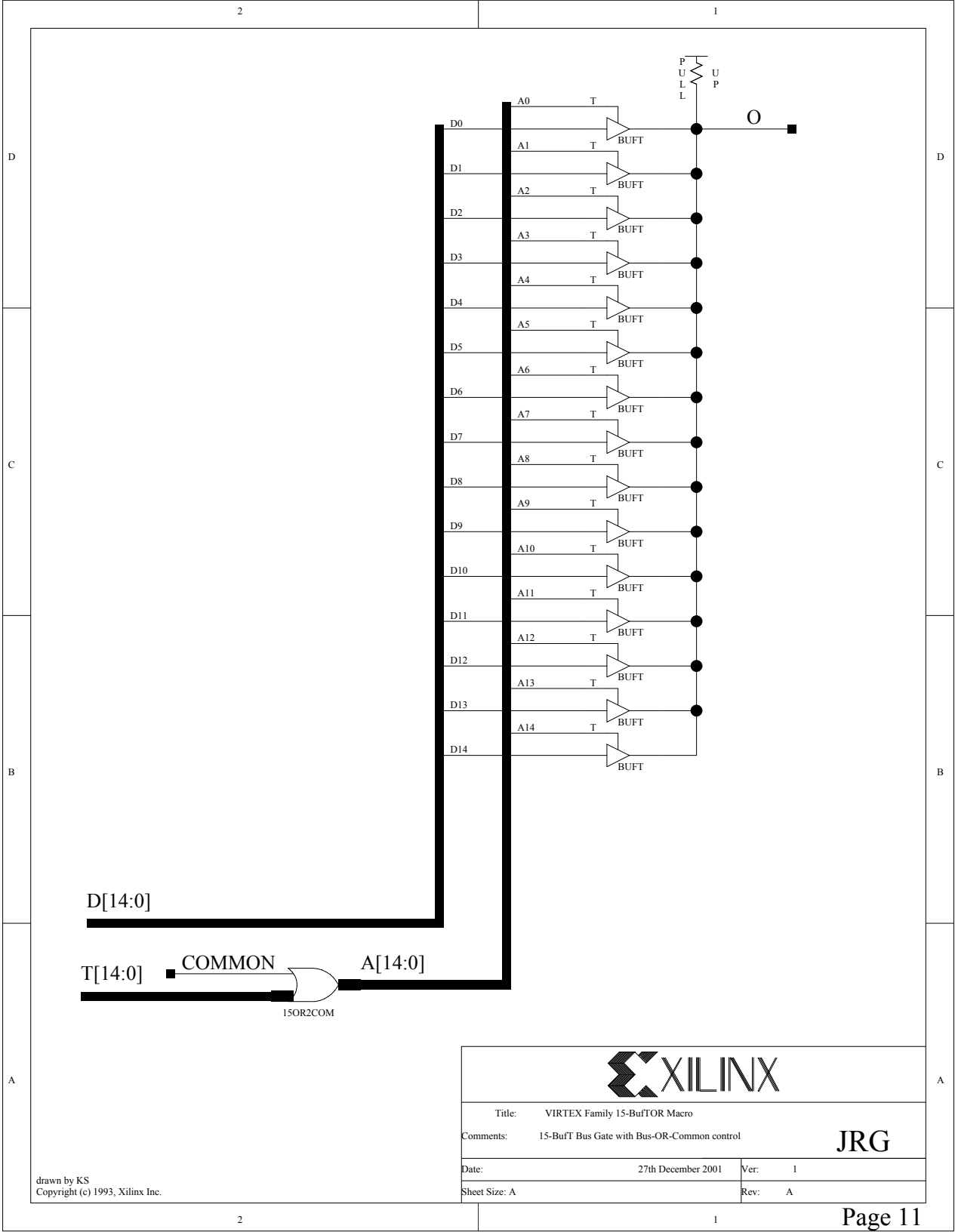




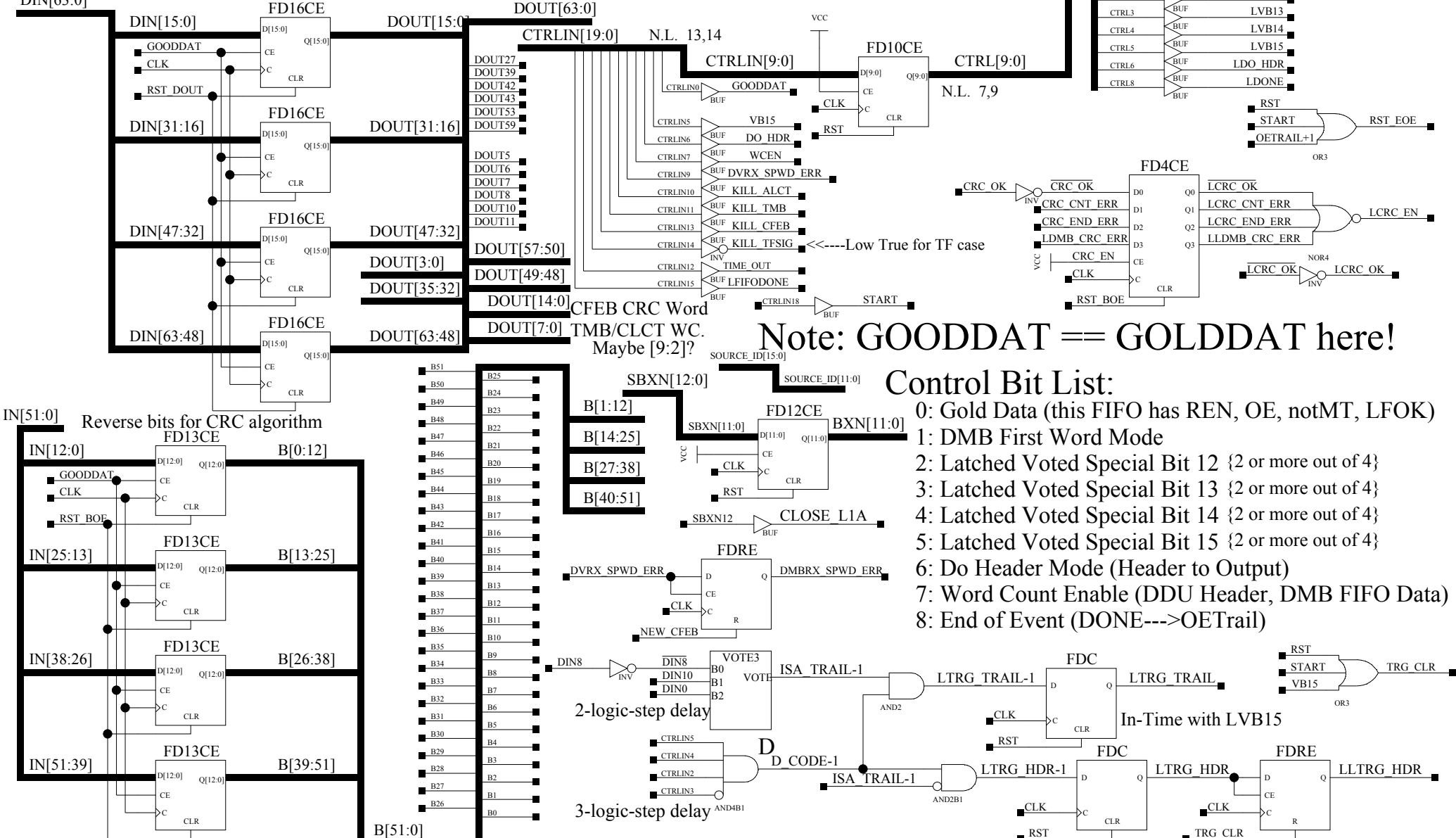








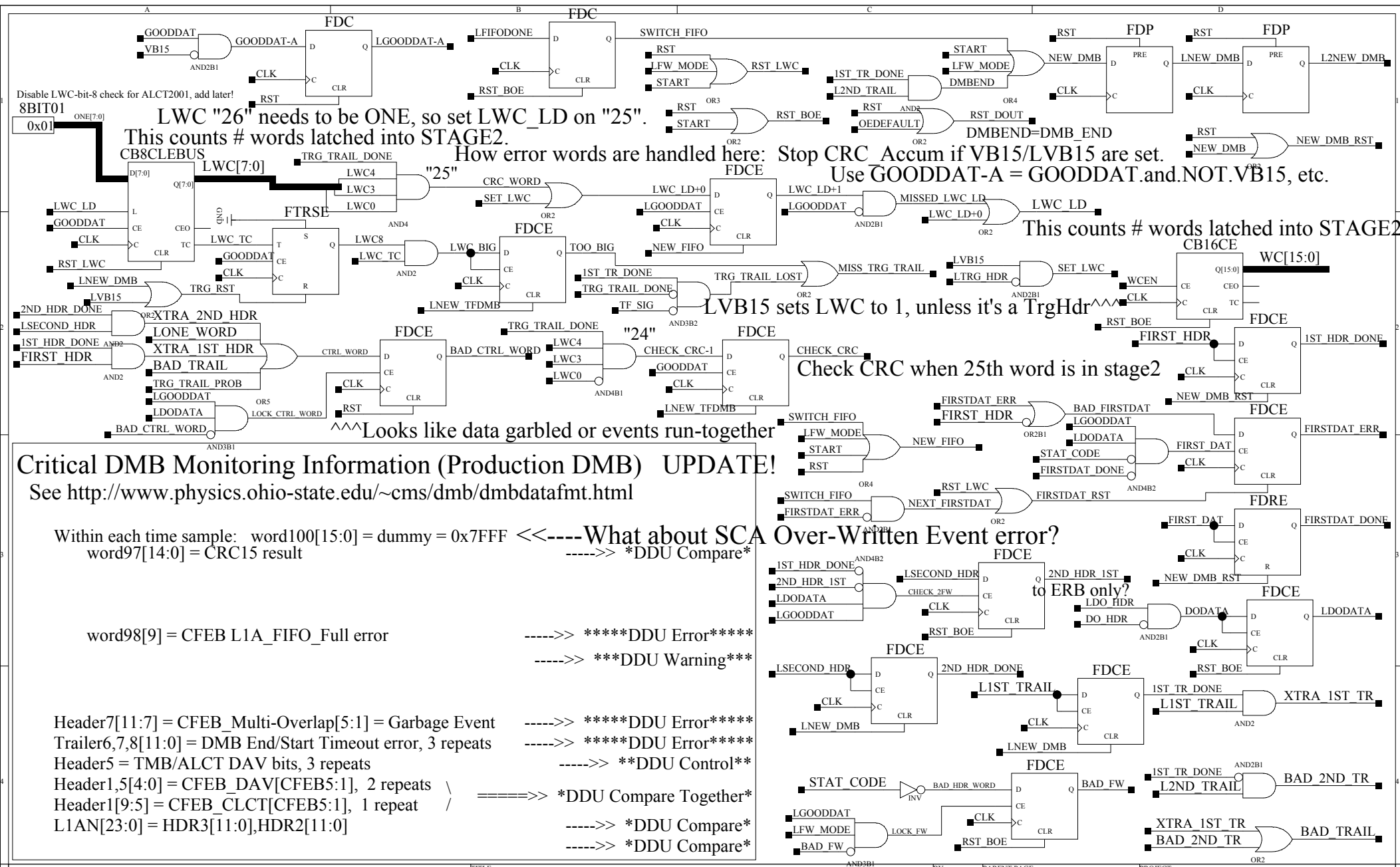
The lowest 13-bits of every 16 go into the CFEB CRC (but reverse them!): 52-bits of data --->15-bit CRC  
 Only the lowest 12-bits of every 16 go into the Special Word Decode (un-reverse these!)



Note: GOODDAT == GOLDDAT here!

### Control Bit List:

- 0: Gold Data (this FIFO has REN, OE, notMT, LFOK)
- 1: DMB First Word Mode
- 2: Latched Voted Special Bit 12 {2 or more out of 4}
- 3: Latched Voted Special Bit 13 {2 or more out of 4}
- 4: Latched Voted Special Bit 14 {2 or more out of 4}
- 5: Latched Voted Special Bit 15 {2 or more out of 4}
- 6: Do Header Mode (Header to Output)
- 7: Word Count Enable (DDU Header, DMB FIFO Data)
- 8: End of Event (DONE--->OETrail)





Need to deserialize b13 in 1st sample for \*EACH CFEB\* and compare to Hdr2d!

Encode to 3 bits + Phase (0), compare to Hdr2d[11-8], can be +/- 1?  
Then what if 2 LCTs are set (overlap)? Encode the lowest bit or SKIP IT

ON for CFEB LWC = 2,3,5,6,8,9,11,12,14,15,17,18,20,21,23,24:

LWC = 2,3,5,6,8,9,11,12,14  
Set/Reset at LWC = 25 or LVB15

Recheck Later-->

Recheck Later--  
May need a programmable offset...

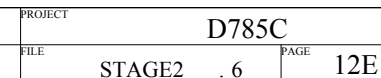
only check L1A for 1st 2 samples^^^

DISABLED!  $\rightarrow_{VCC}$

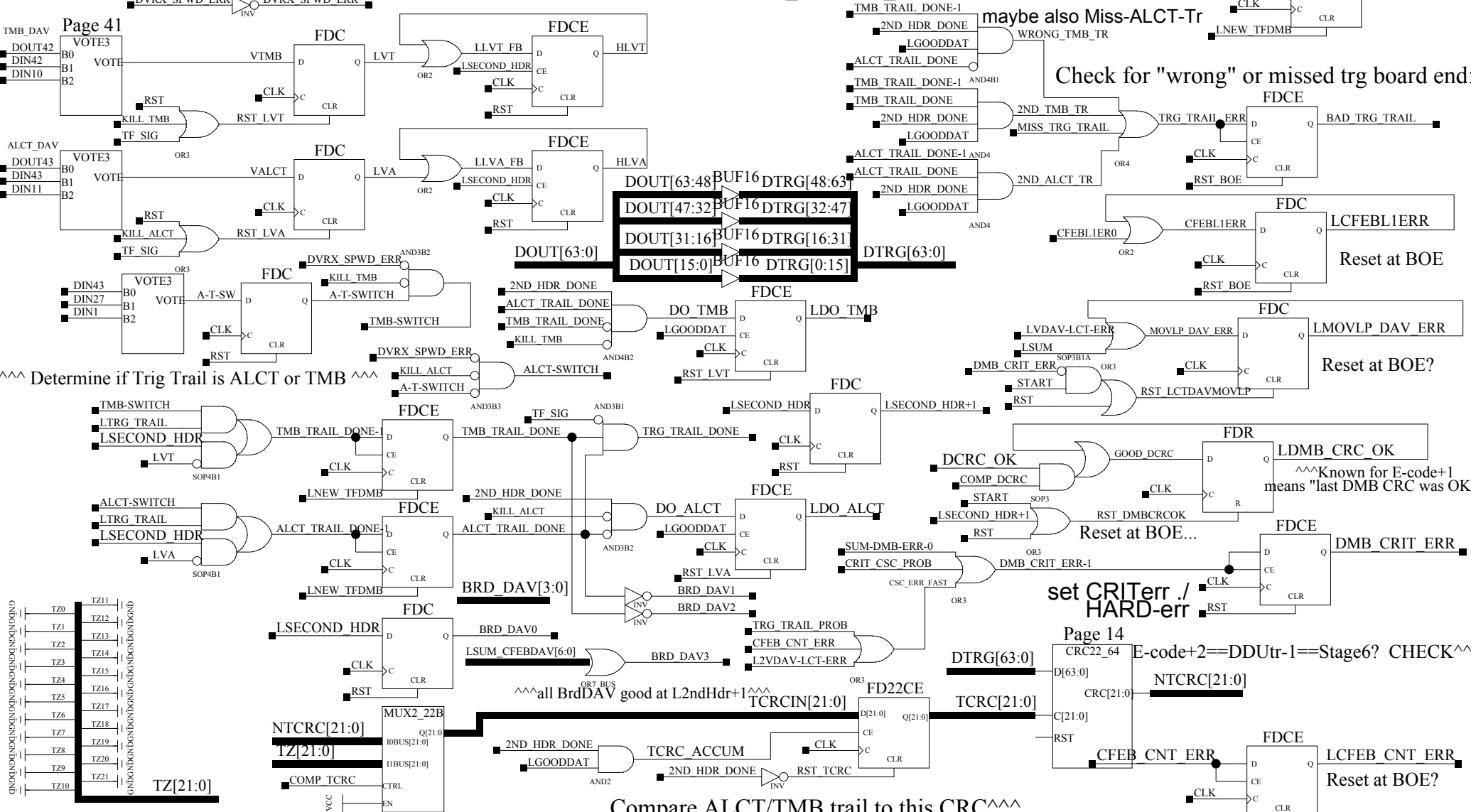




## CSC "Reset Needed" register



Trigger CRC Check Control: assume that TMB comes after ALCT!  
 ^^^affects L1A check: DoTMB, 1st\_TMB/1st\_ALCT

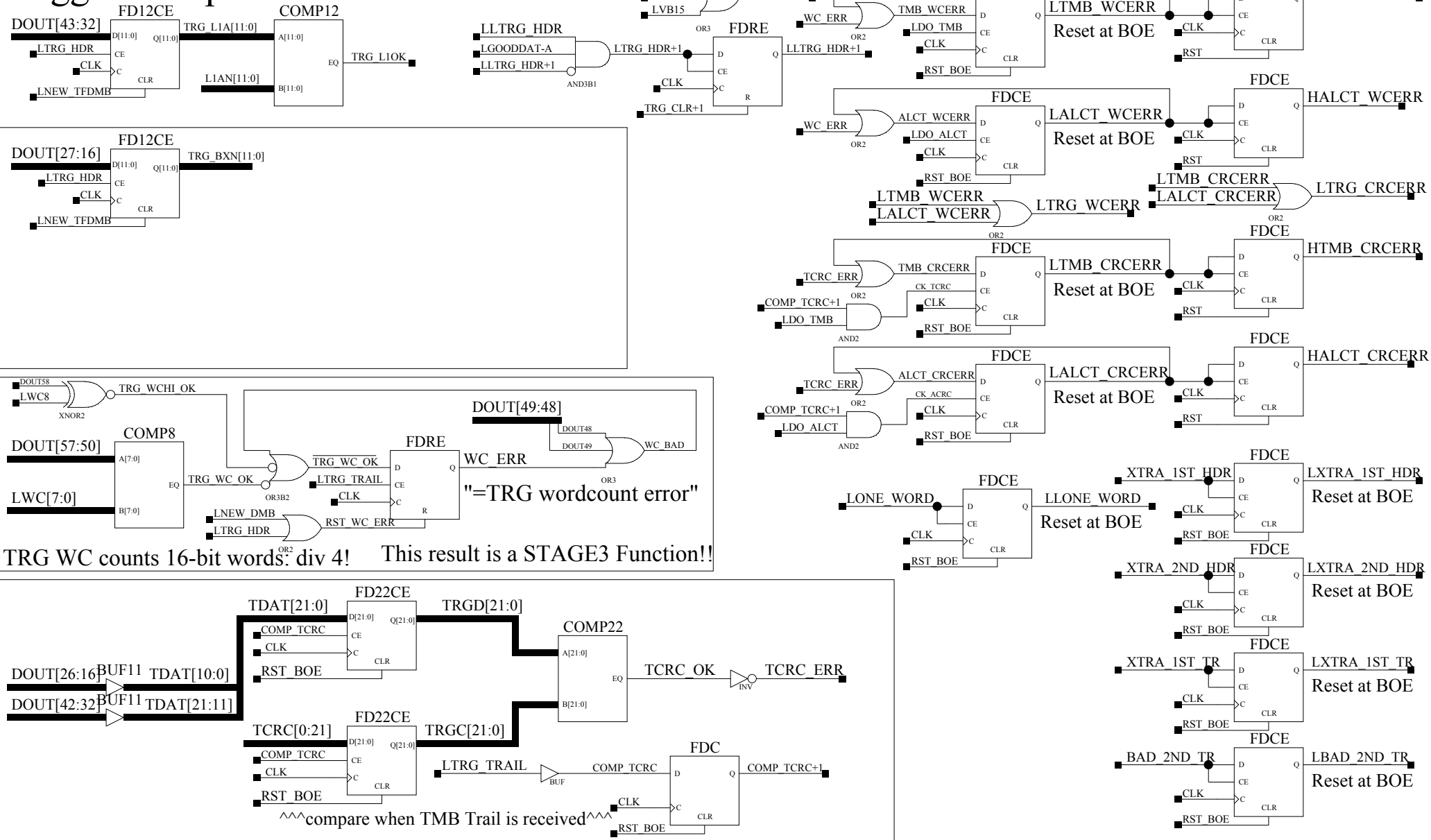


TZ[21:0]  
 TZ11  
 TZ12  
 TZ13  
 TZ14  
 TZ15  
 TZ16  
 TZ17  
 TZ18  
 TZ19  
 TZ20  
 TZ21

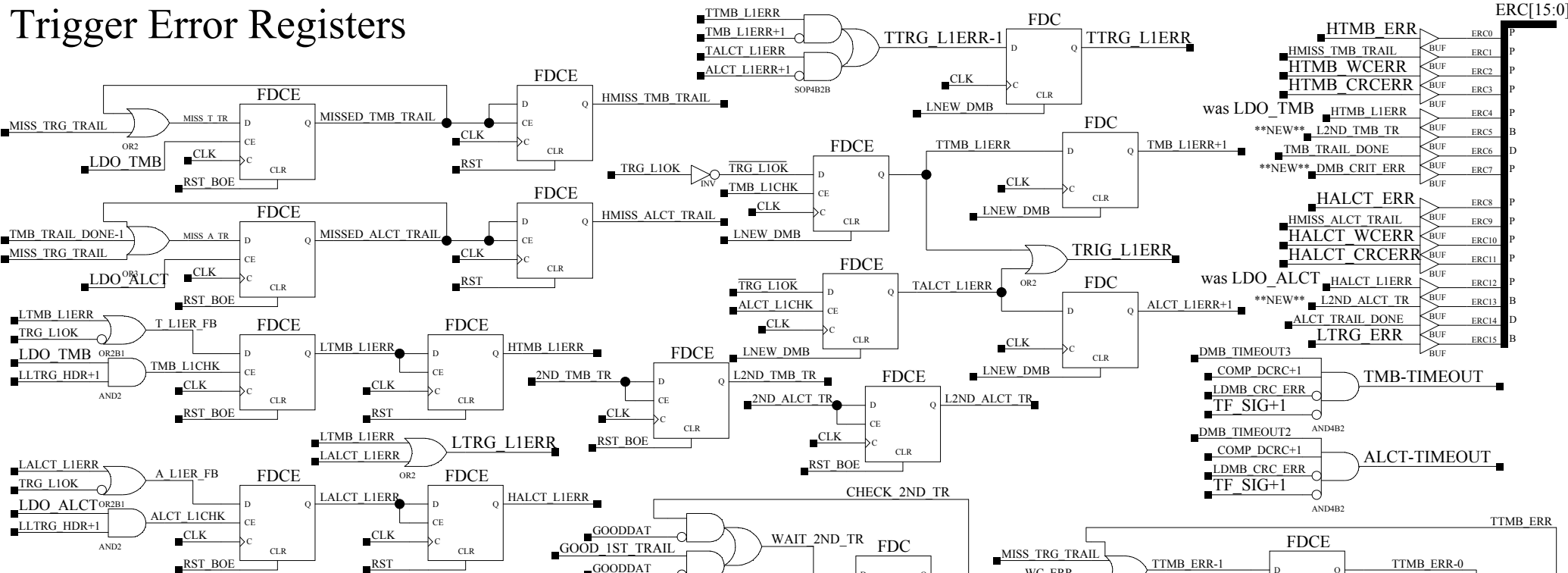
Load TCRC with ZERO on ALCT/TMB trail^^^

Compare ALCT/TMB trail to this CRC^^^

## Trigger Comparisons and Error Checks

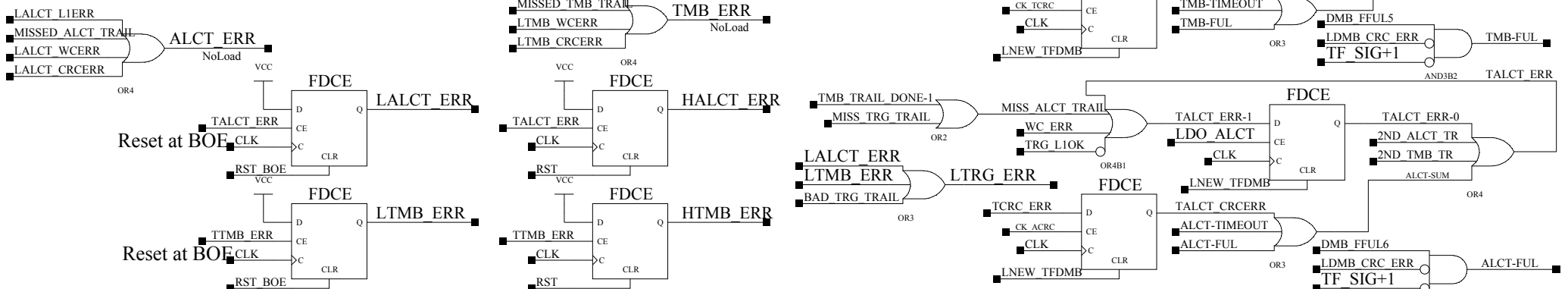


## Trigger Error Registers

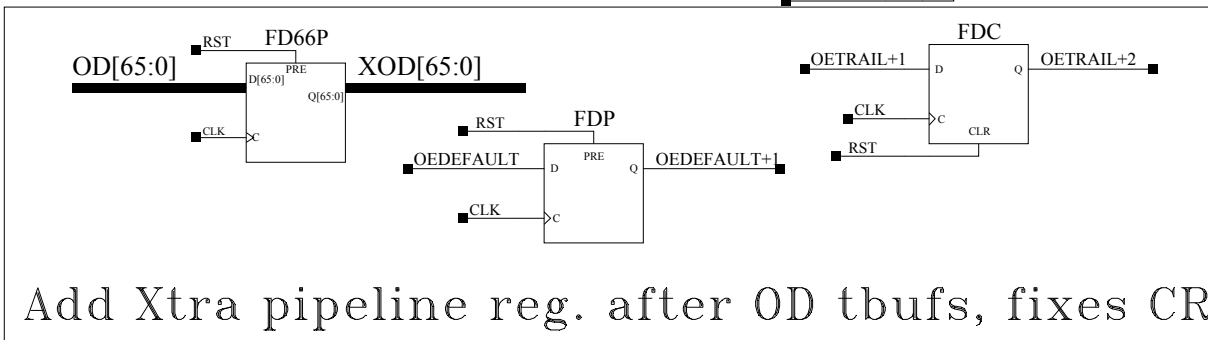
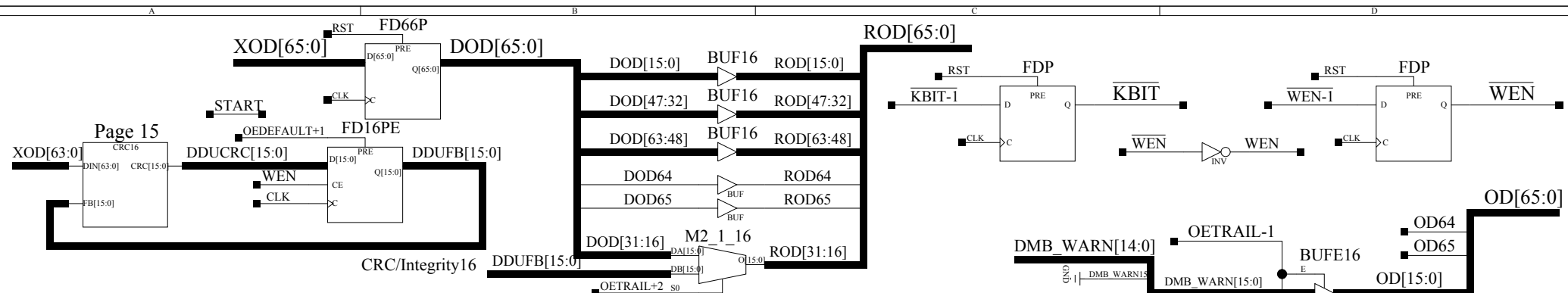


## TMB/ALCT need Err Reg's for CSC/EVT

CRC: Evt      WC: Evt      L1err: Evt  
TMBerr: CSC&Evt      ALCTerr: CSC&Evt







Add Xtra pipeline reg. after OD tbufs, fixes CRCs?

## DDU Timing Info

DDUctrl to InFIFO signals: 2" - 4", .3ns - .6ns  
 IRCLK has 4 loads, may slow signal by 0.1-0.5ns?  
 CKFBout has normal drive, IRCLK has ~1.1ns Faster drive

## FPGA I/O Delays (lvcmos33, ns)

IBUF: 0.92  
 IFD set/hold: 0.92/-0.12 Clk to Q: 0.65

OBUF: 2.33

OFD set/hold: 0.26/0.14 Clk to Q: 2.41

\*modifiers for drive/slew settings:

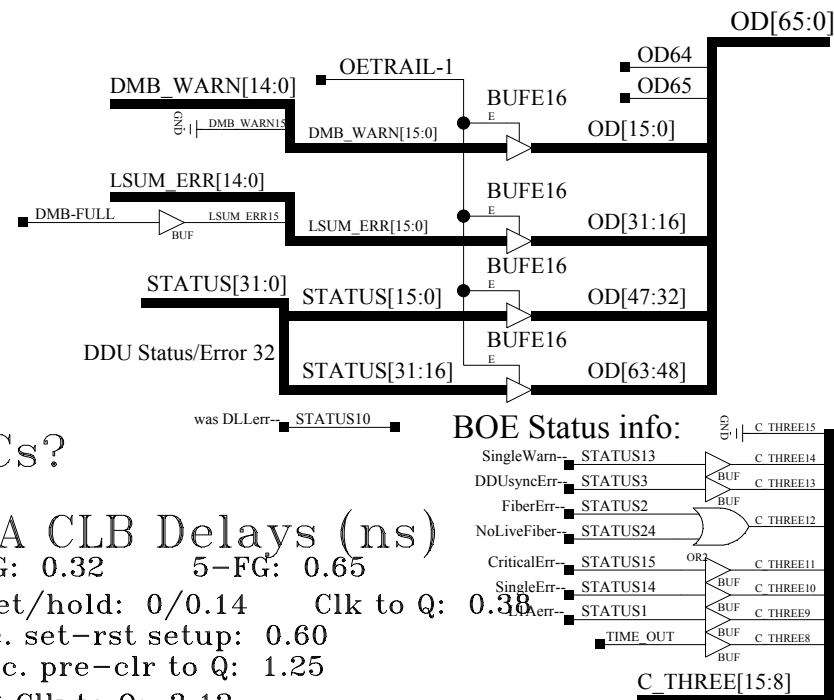
6mA: add 2.60 for Slow, 1.28 for Fast  
 8mA: add 1.69 for Slow, 0.46 for Fast  
 12mA: add 1.18 for Slow, 0.26 for Fast  
 16mA: add 0.52 for Slow, 0.02 for Fast  
 24mA: +0.44 for Slow, -0.08 for Fast

## FPGA CLB Delays (ns)

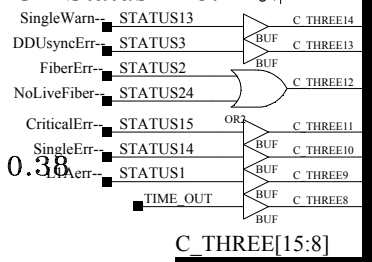
4-FG: 0.32 5-FG: 0.65  
 FD set/hold: 0/0.14 Clk to Q: 0.38  
 Sync. set-rst setup: 0.60  
 Async. pre-clr to Q: 1.25  
 SR16 Clk to Q: 3.12  
 SR32 Clk to Q: 3.49  
 SI set/hold: 0.34/0.01 Q11 (low state) 3.22-3.34 3.23

## TI FIFO I/O Delays (ns)

RCLK to Empty (low state) Vcc: 3.38V 3.04V  
 Max: 3.6, Min: 2.5 3.02-3.18 3.20-3.29  
 to Not Empty (high state) 3.22-3.34 3.23-3.31  
 RCLK to Q11 False (low state)  
 Max: 4.3, Min: 2.5 3.32-3.62 3.40-3.64  
 to Q11 True (high state) 3.31-3.87 3.51-4.06

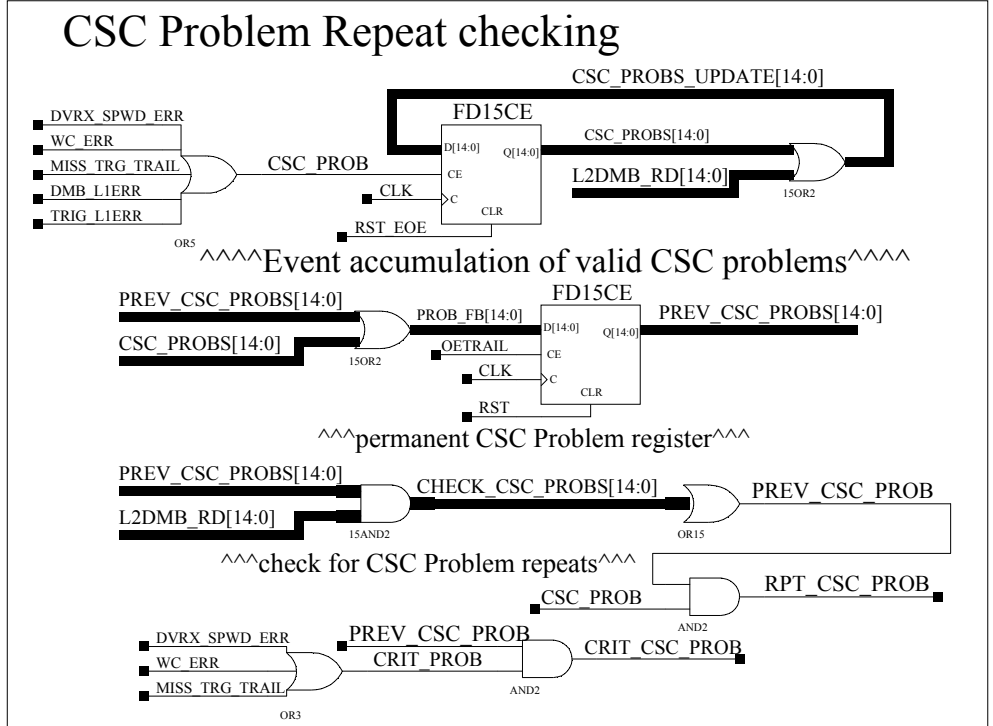
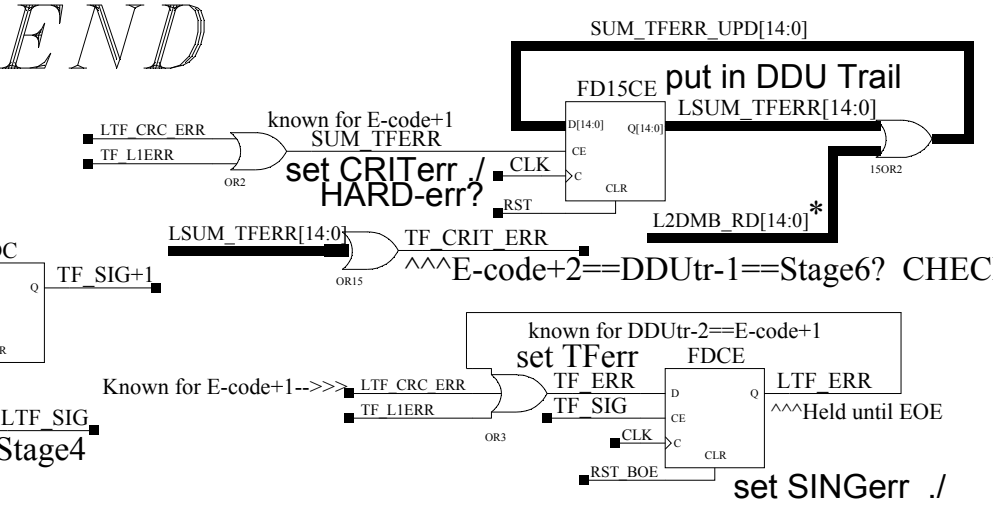
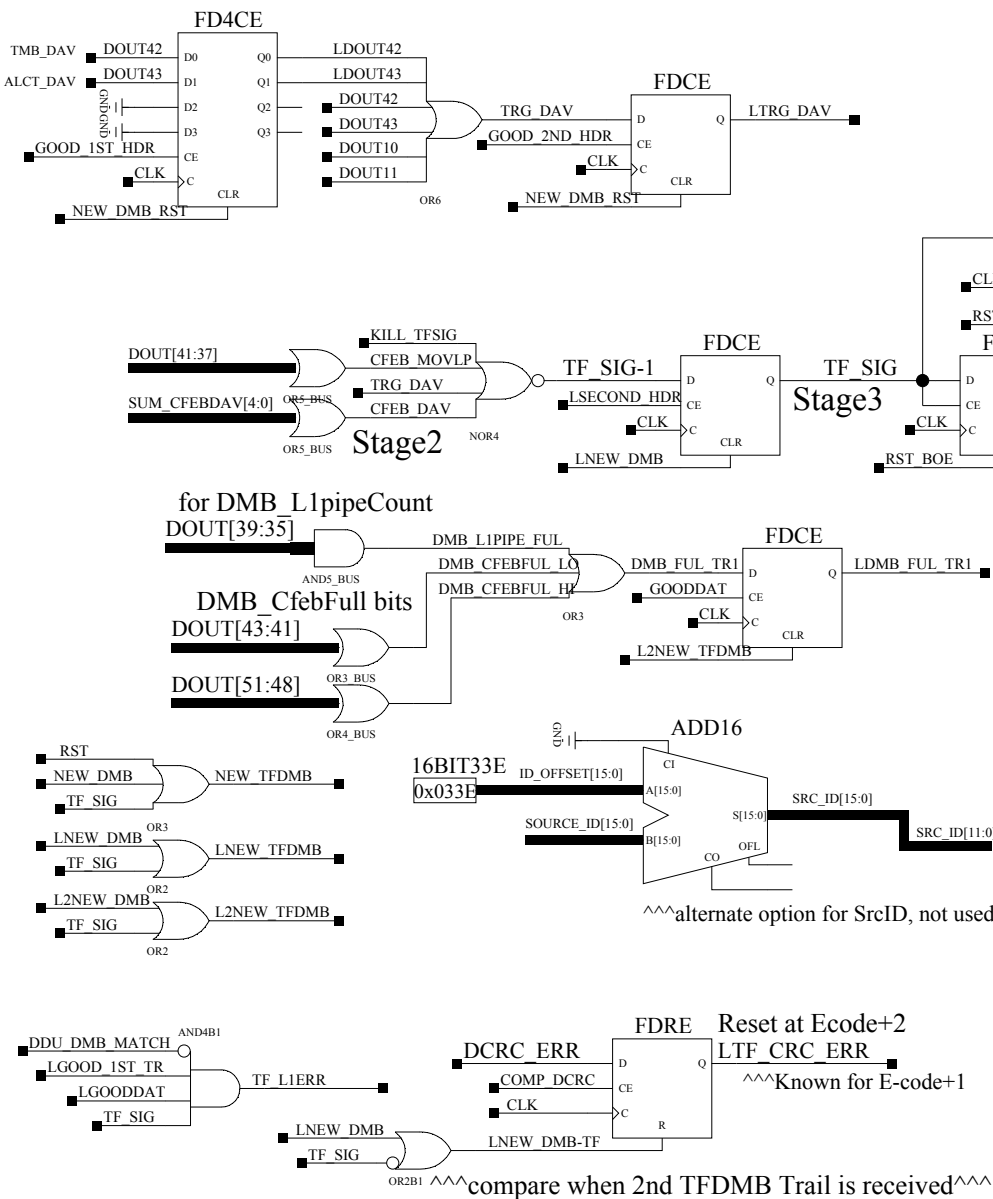


## BOE Status info:

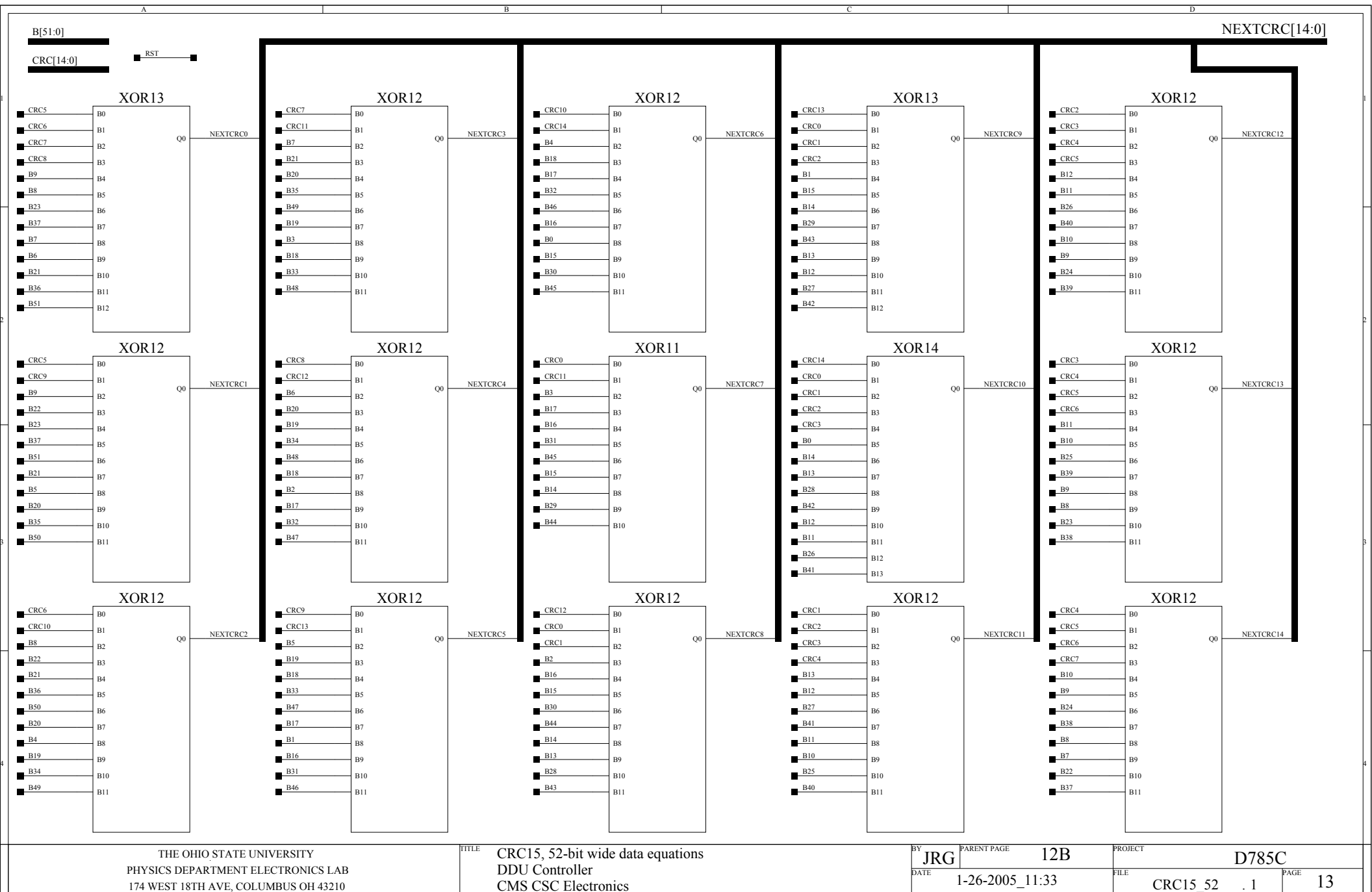


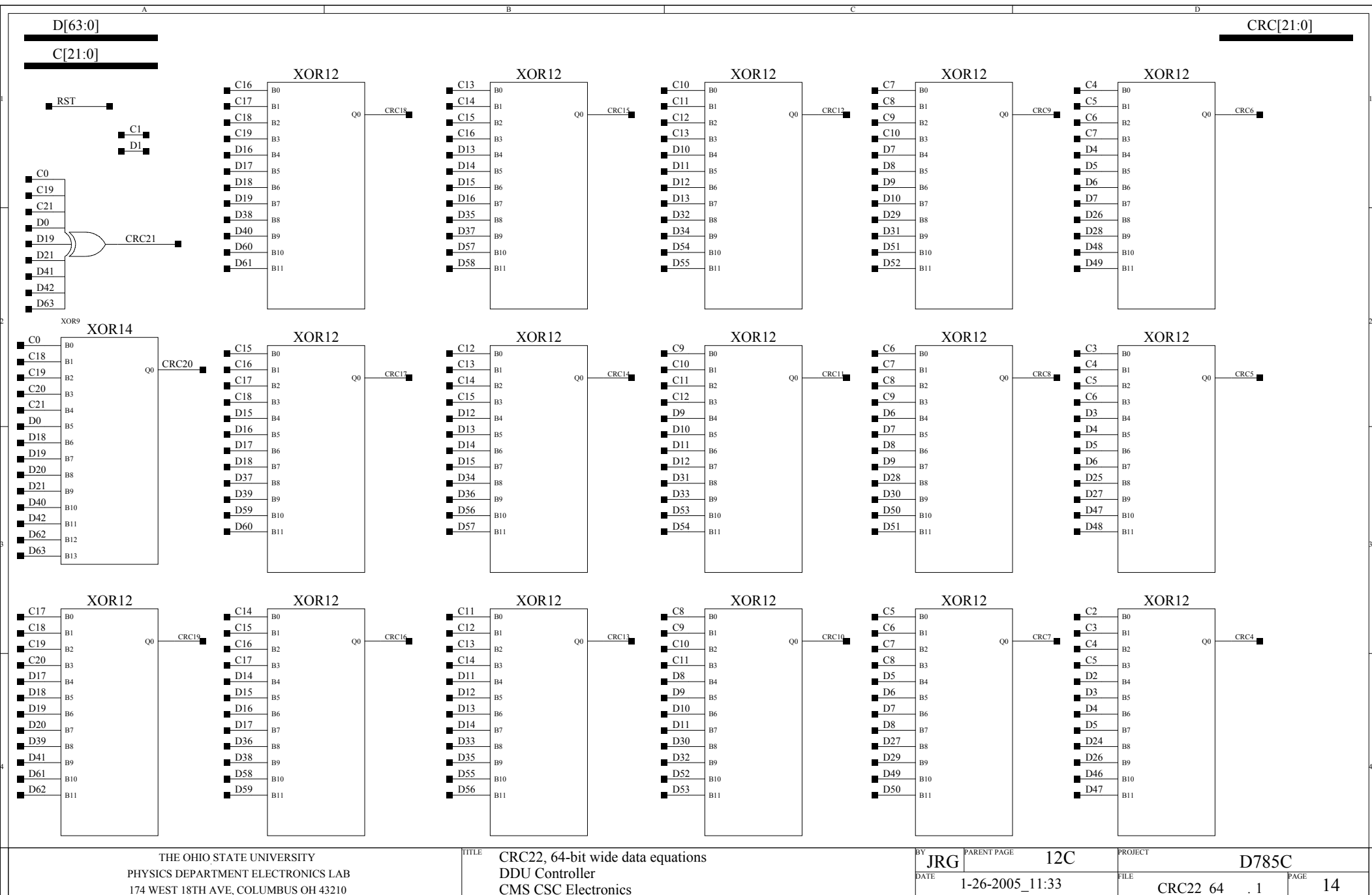
Check for Track Finder signal, record TF errors

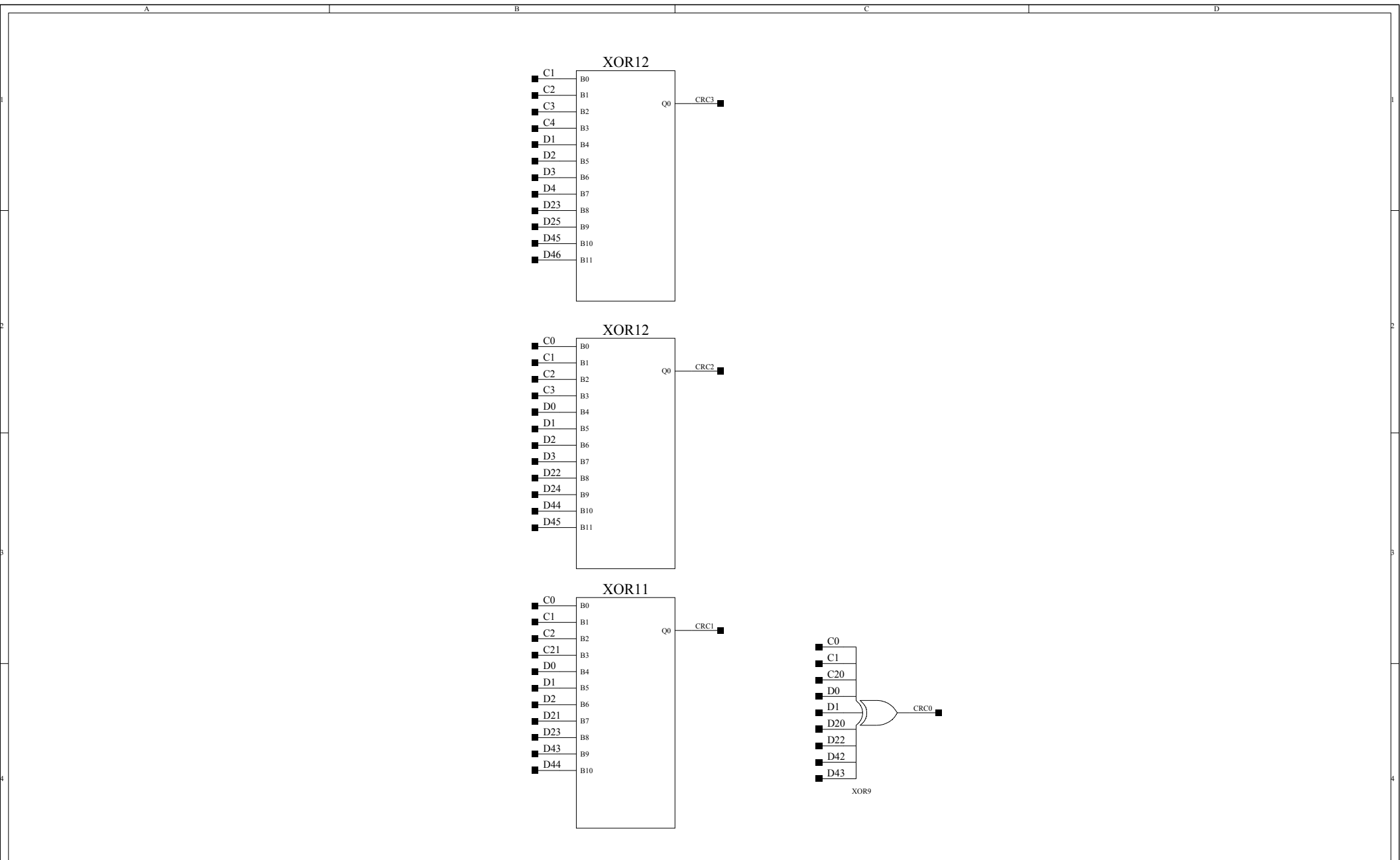
END



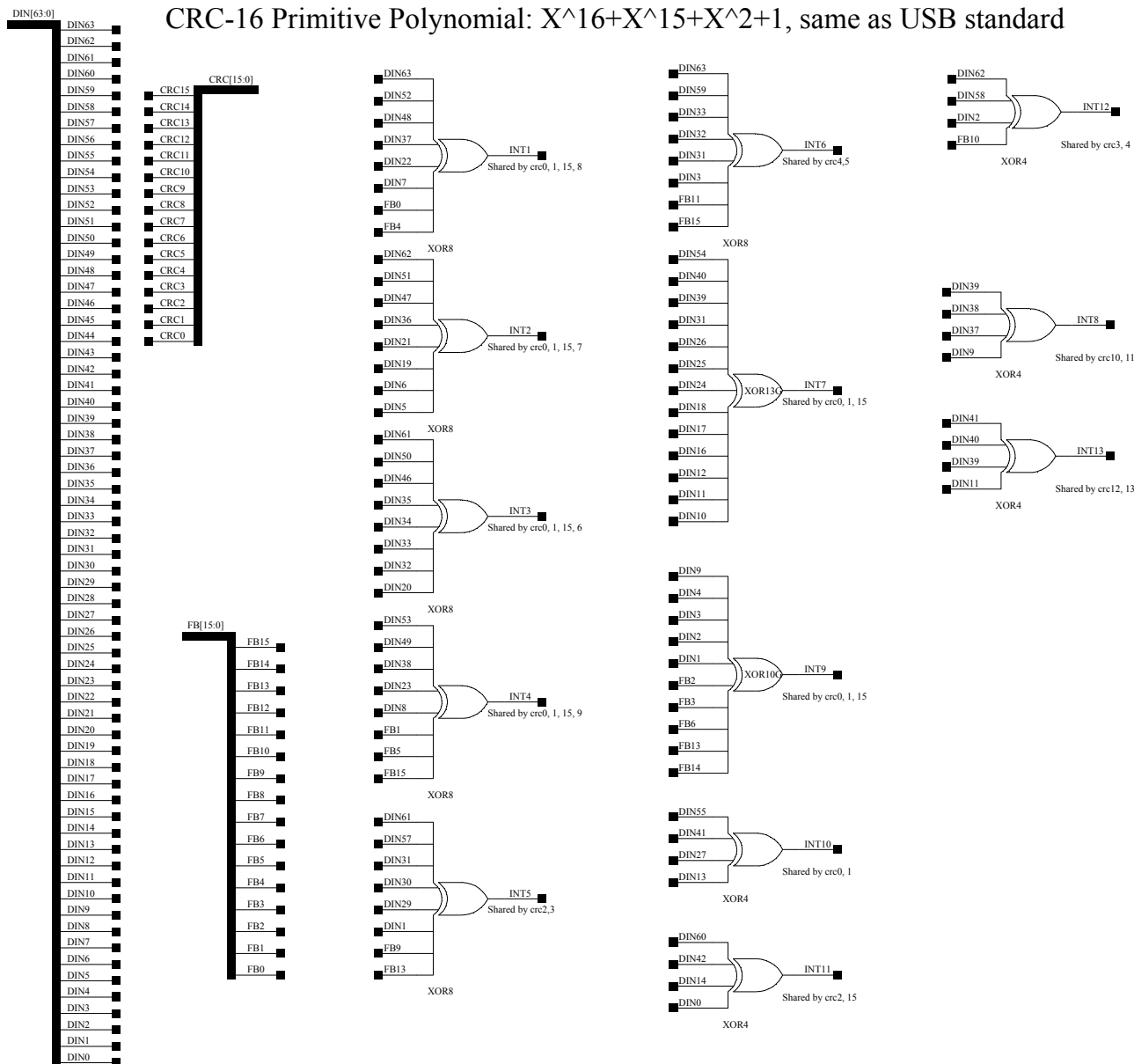


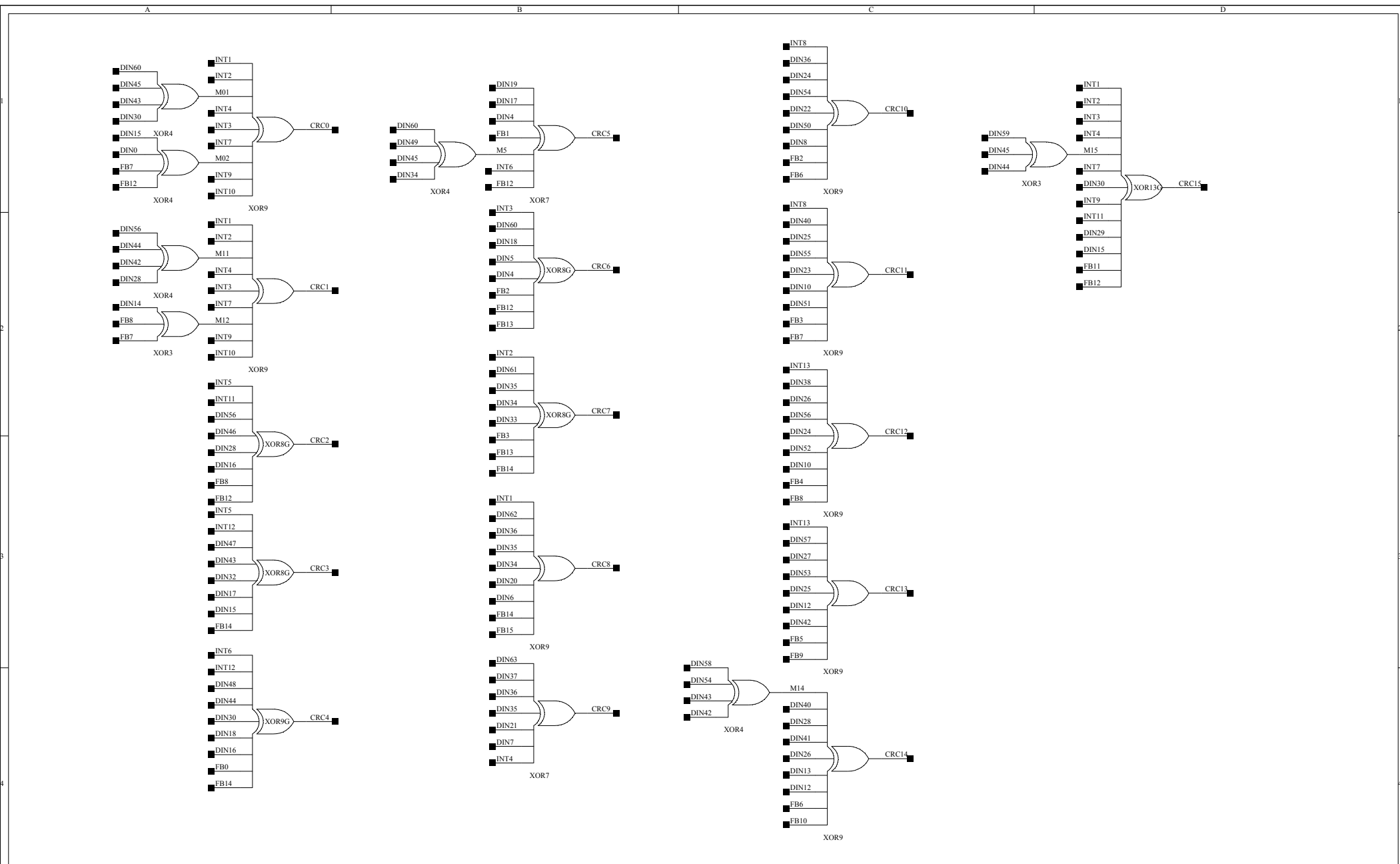




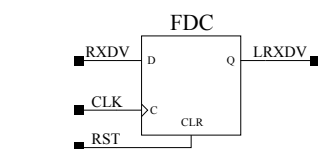
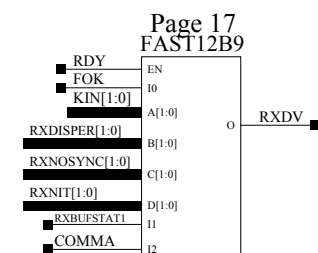
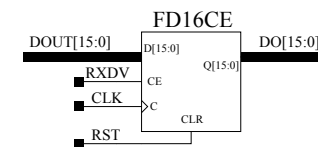
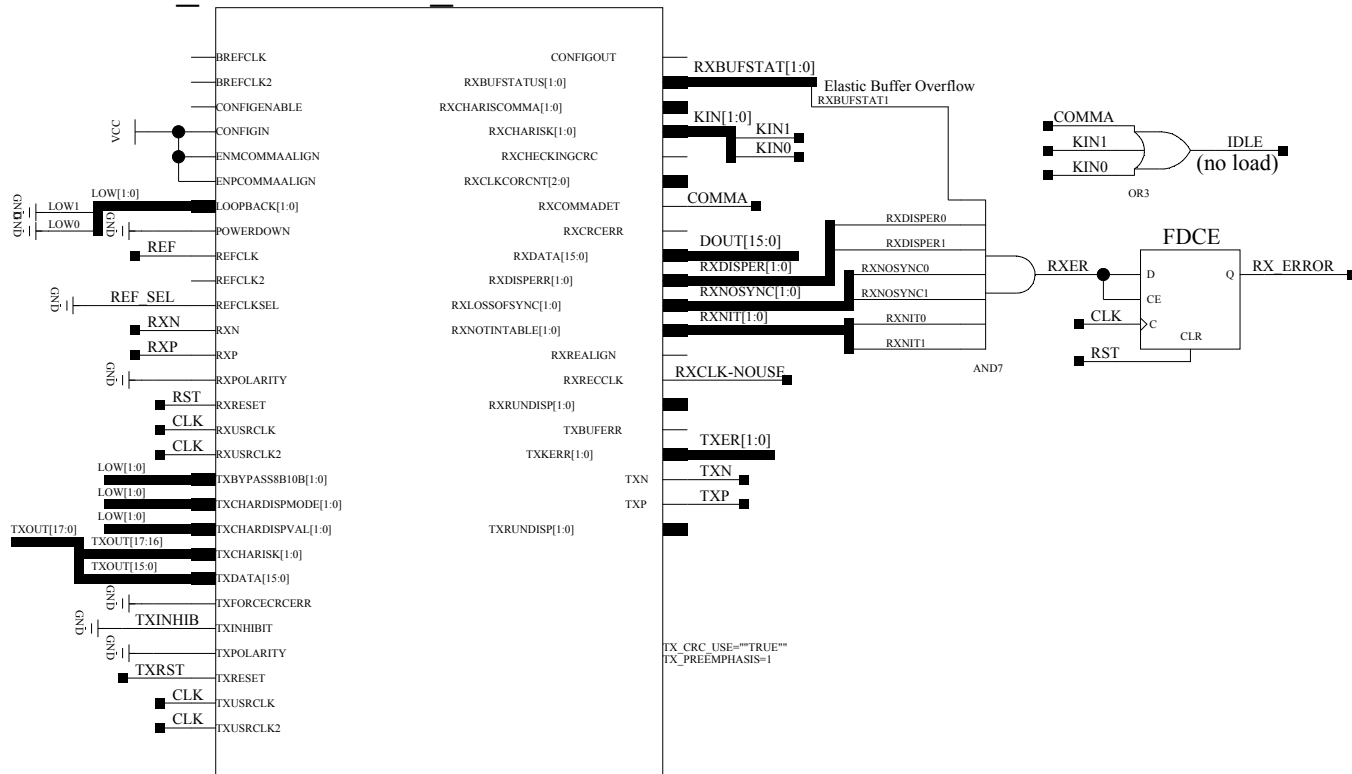


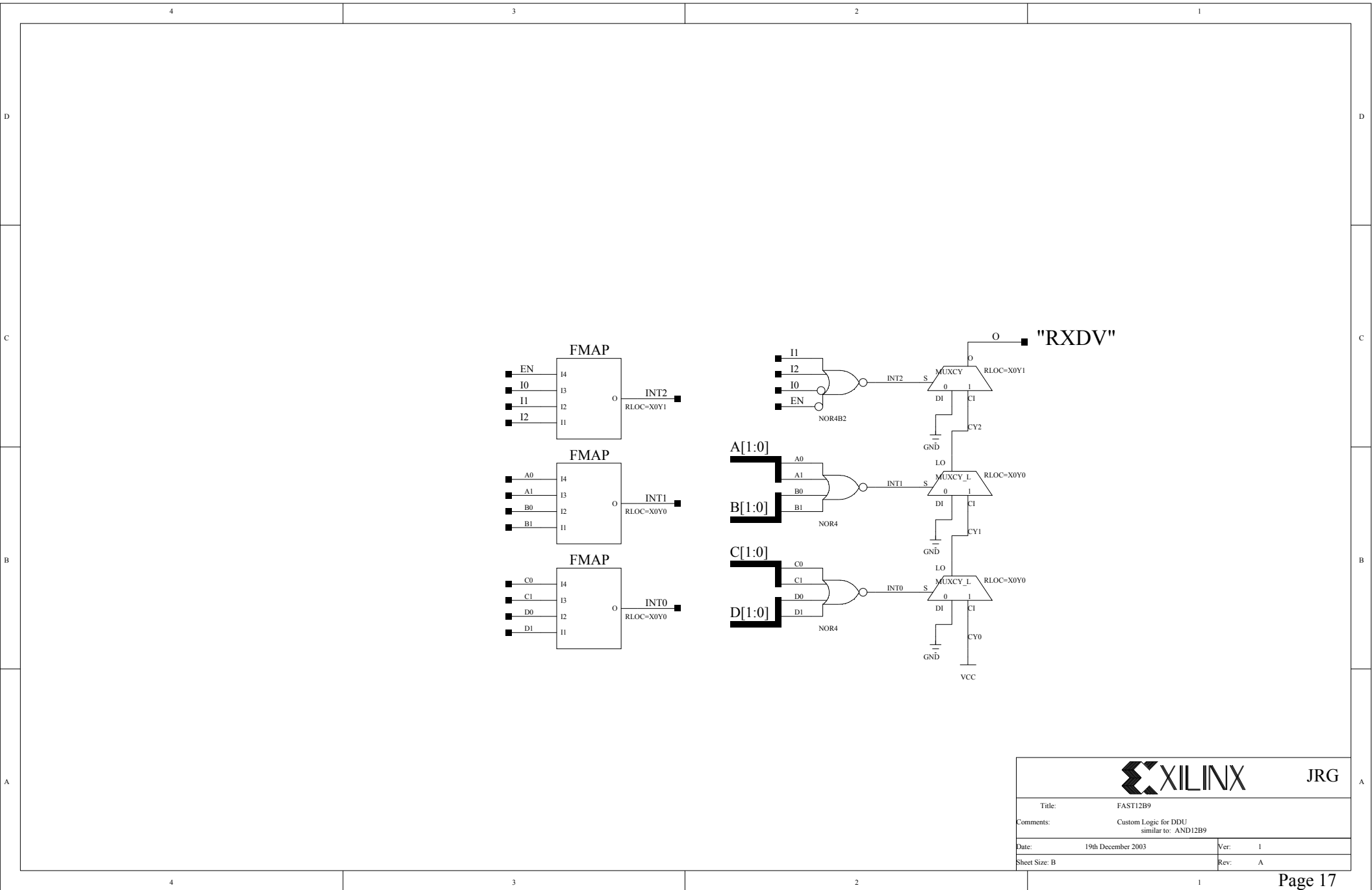
# CRC-16 Primitive Polynomial: $X^{16}+X^{15}+X^2+1$ , same as USB standard





---> Not done yet! Consider a counter to skip 1st ~12 bytes after K word. Skip 4 CRC bytes too.

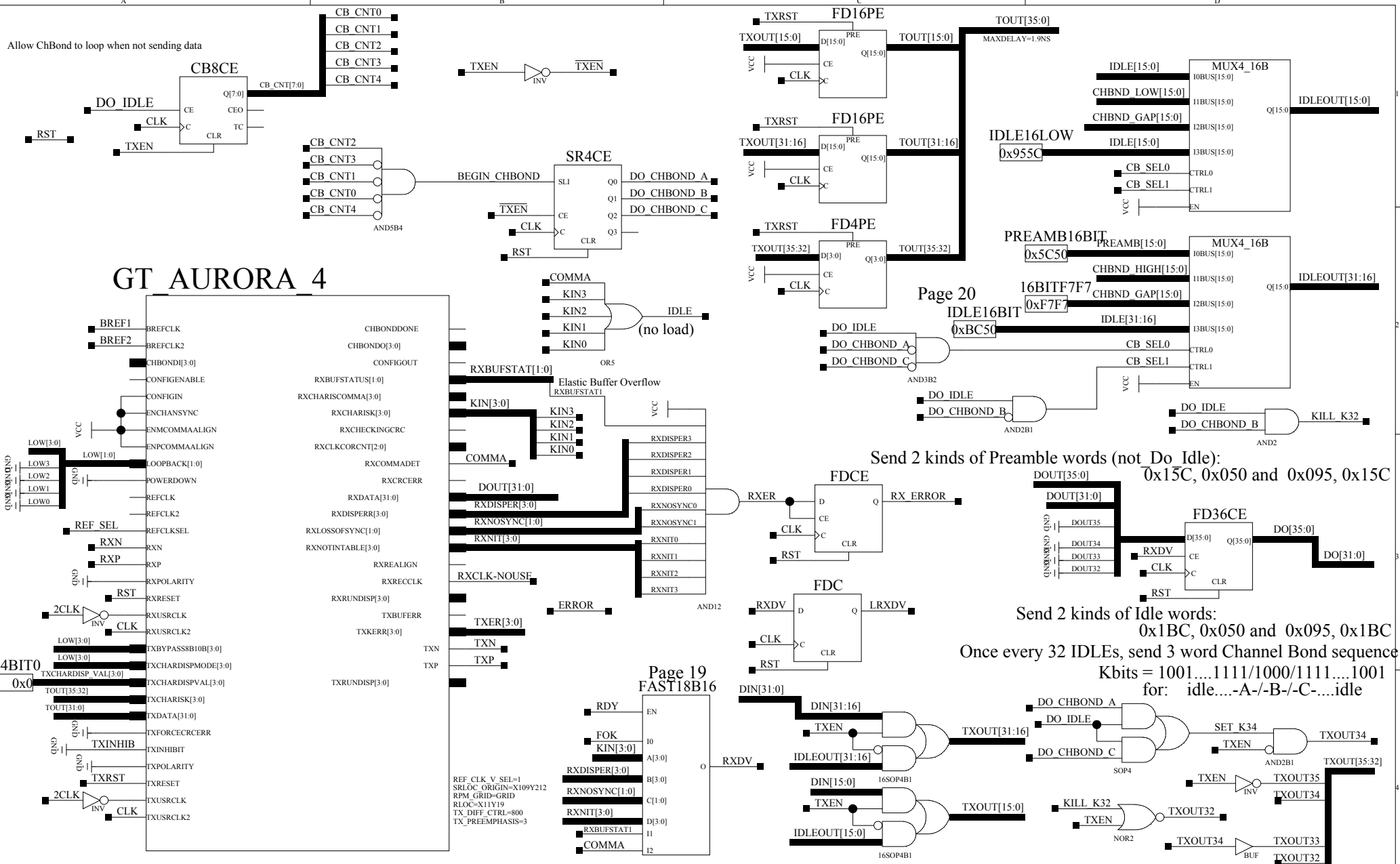




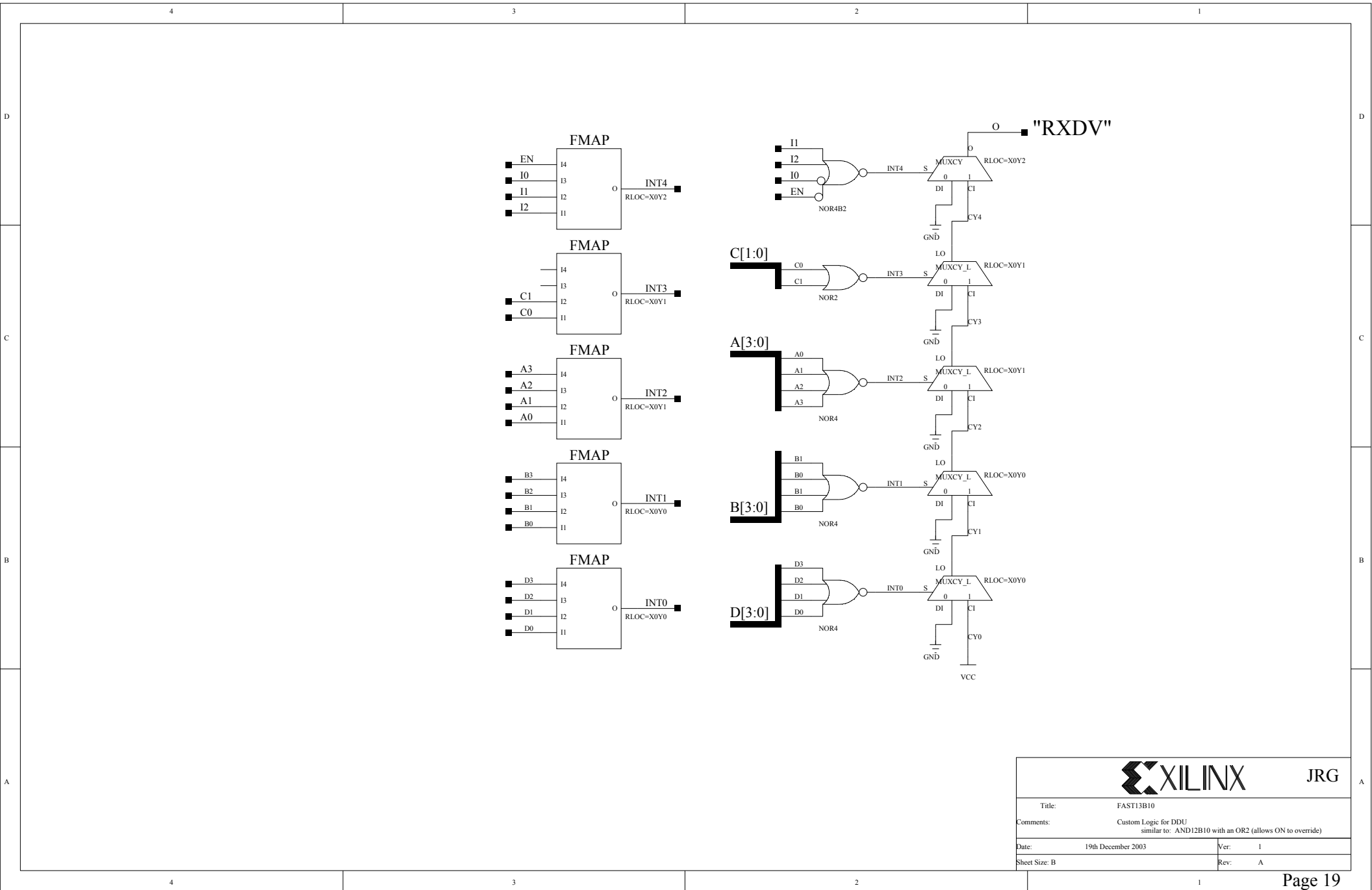
JRG

|               |                                          |
|---------------|------------------------------------------|
| Title:        | FAST12B9                                 |
| Comments:     | Custom Logic for DDU similar to: AND12B9 |
| Date:         | 19th December 2003                       |
| Sheet Size: B | Ver: 1                                   |
|               | Rev: A                                   |

Allow ChBond to loop when not sending data

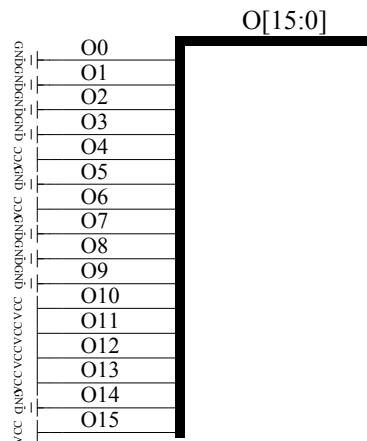


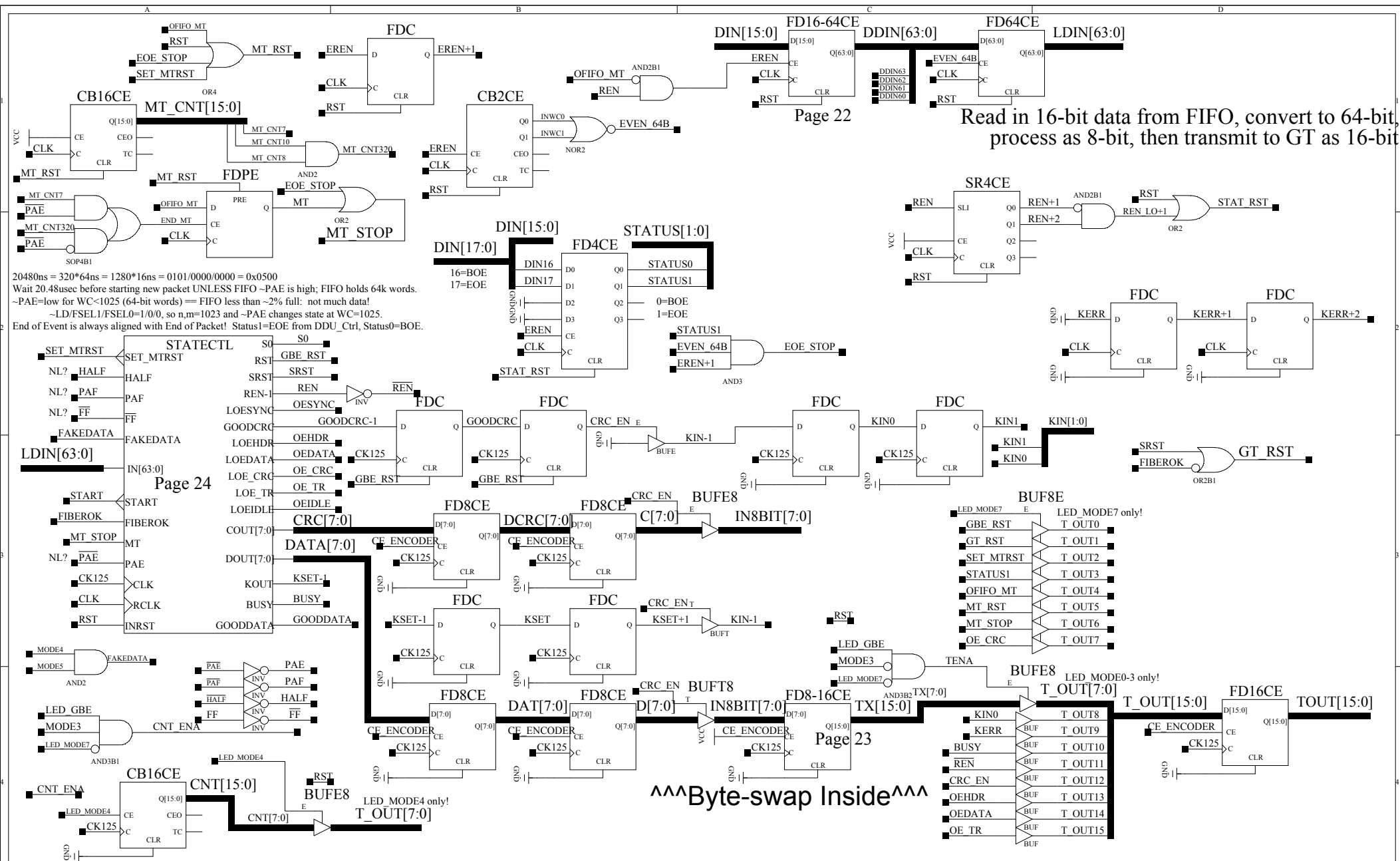




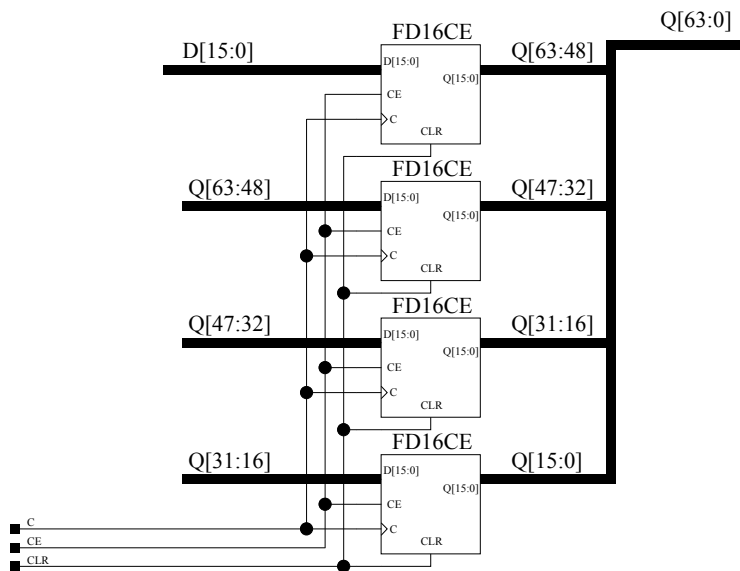
Send 2 Idle bytes:

K28.5(10111100)+D16.2(01010000)  
= 0x1BC + 0x050 (time-ordered)  
= 0xBC50 (in parallel)









JRG

Title: VIRTEX Family FD16-64CE Macro  
Comment: 64-Bit Bus Matching Register with Asynchronous Clear and Chip Enable

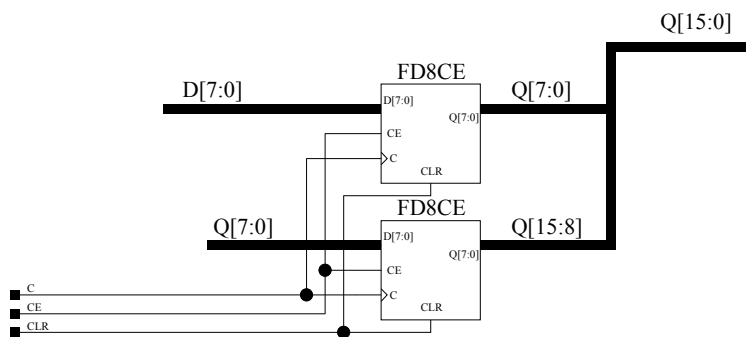
|             |                   |      |   |
|-------------|-------------------|------|---|
| Date:       | 2nd February 2004 | Ver: | 1 |
| Sheet Size: | B                 | Rev: | A |

4

3

2

1



JRG

|             |                   |                                                                        |   |
|-------------|-------------------|------------------------------------------------------------------------|---|
| Title:      |                   | VIRTEX Family FD8-16CE Macro                                           |   |
| Comments:   |                   | 8-16-Bit Bus Matching Register with Asynchronous Clear and Chip Enable |   |
| Date:       | 4th February 2004 | Ver:                                                                   | 1 |
| Sheet Size: | B                 | Rev:                                                                   | A |

4

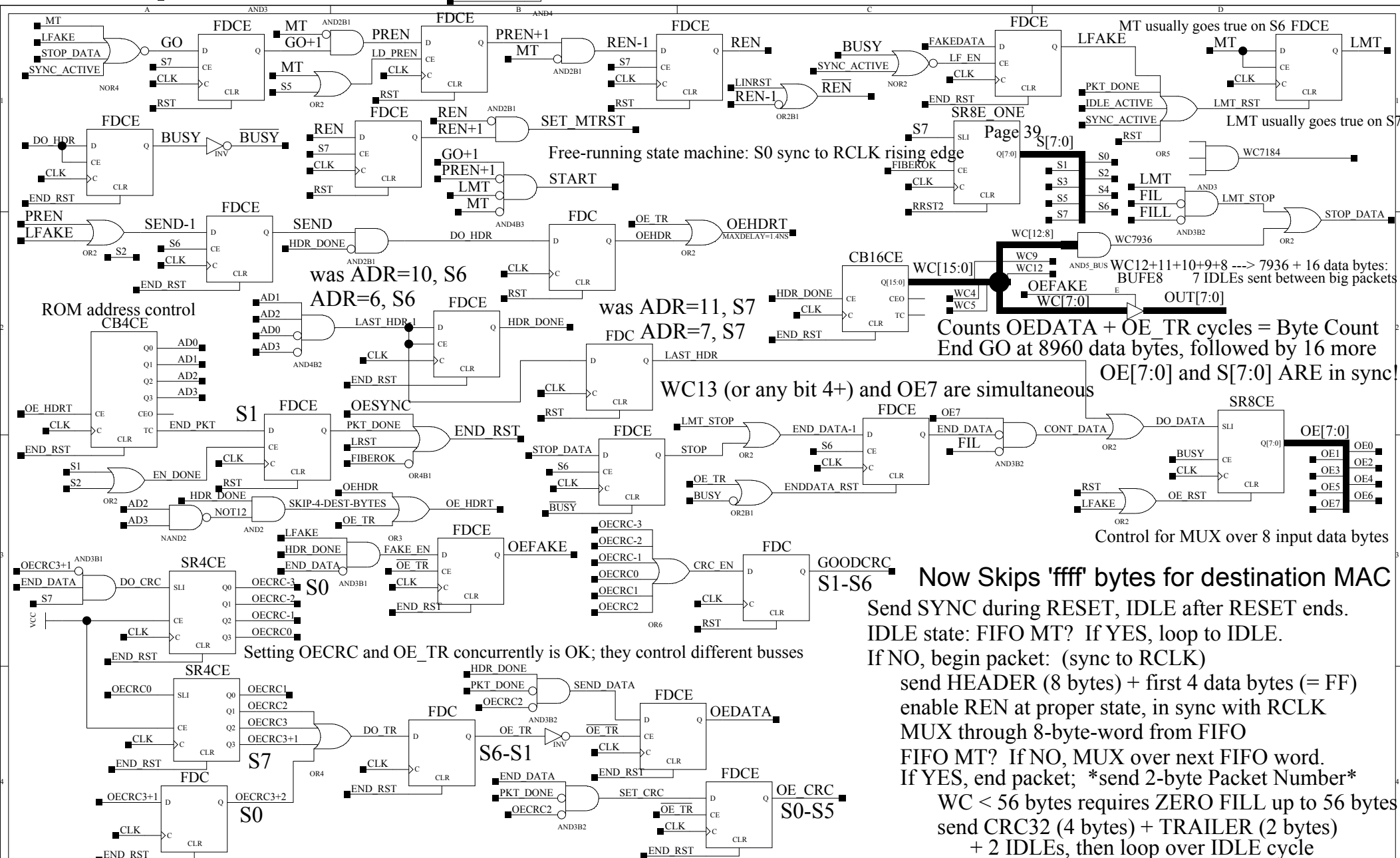
3

2

1

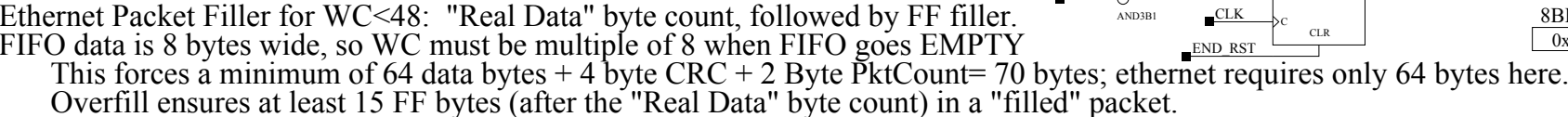
WC13+9+8 ---> 8960 + 16 data bytes:

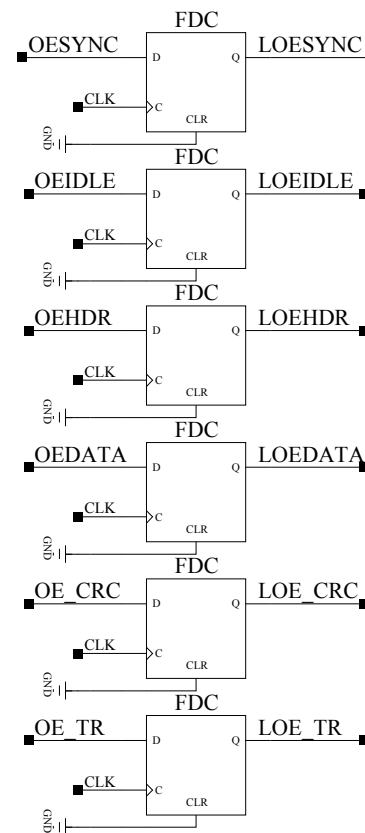
WC12+11+10+9 ----> 7680 + 16 data bytes:

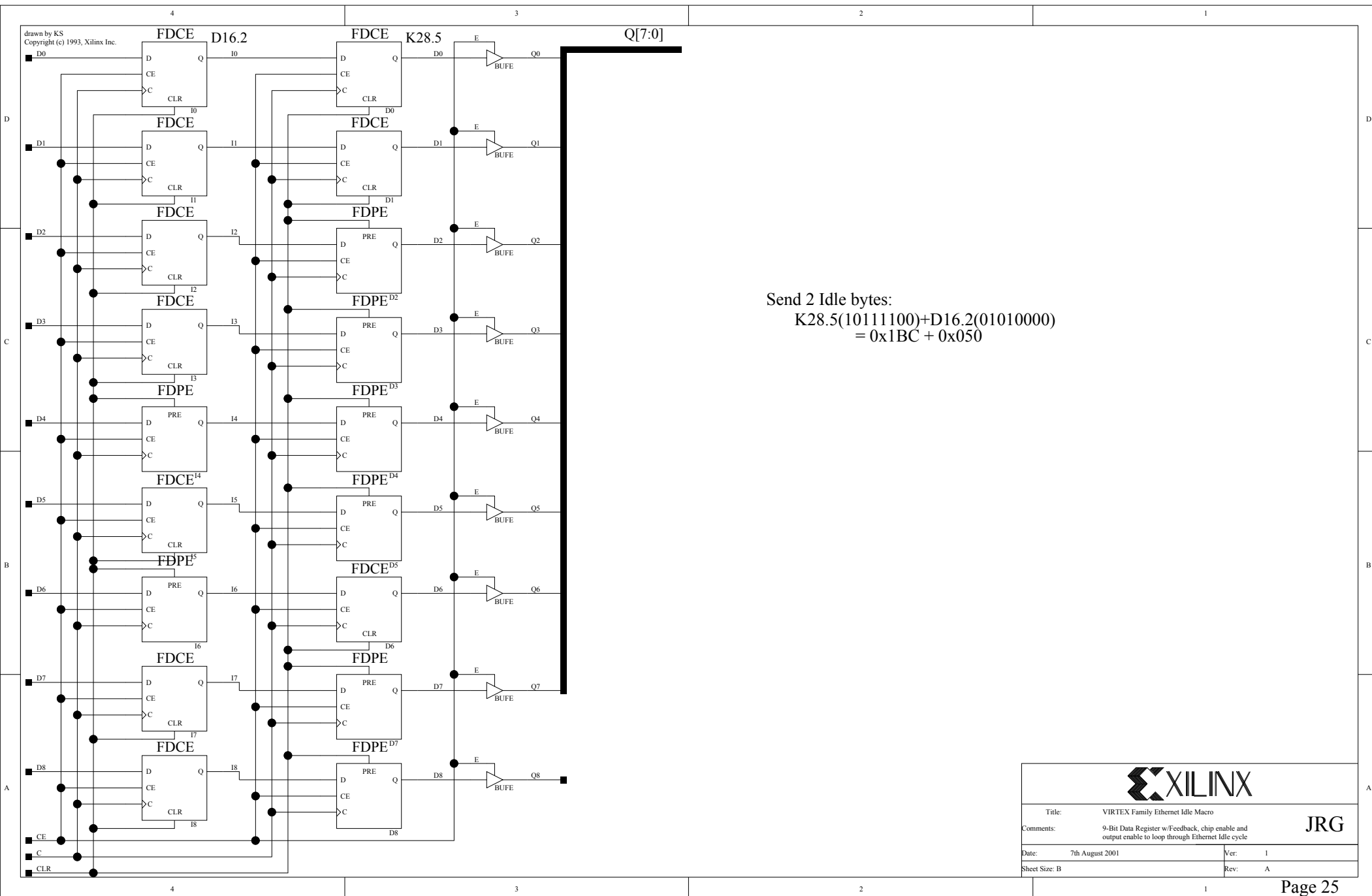




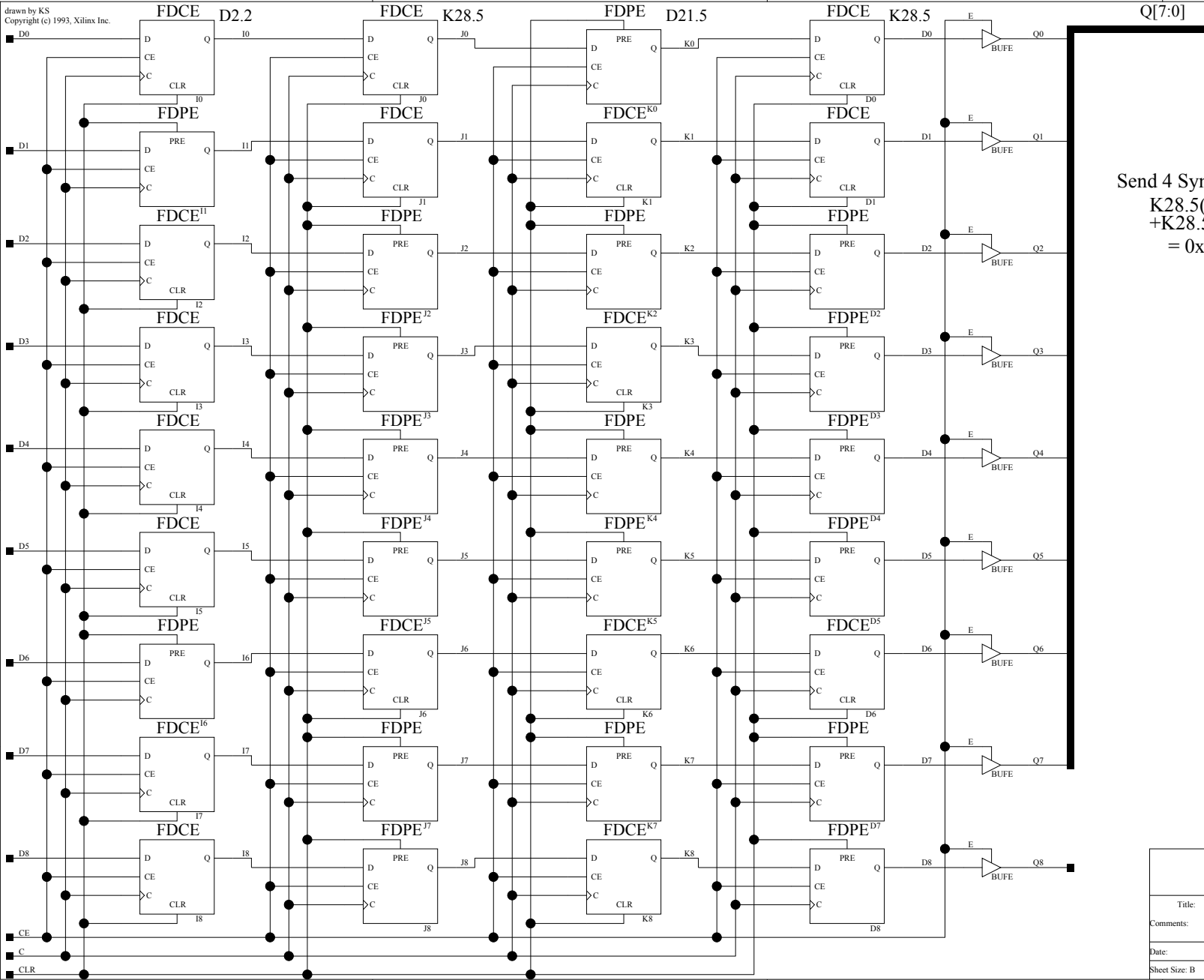








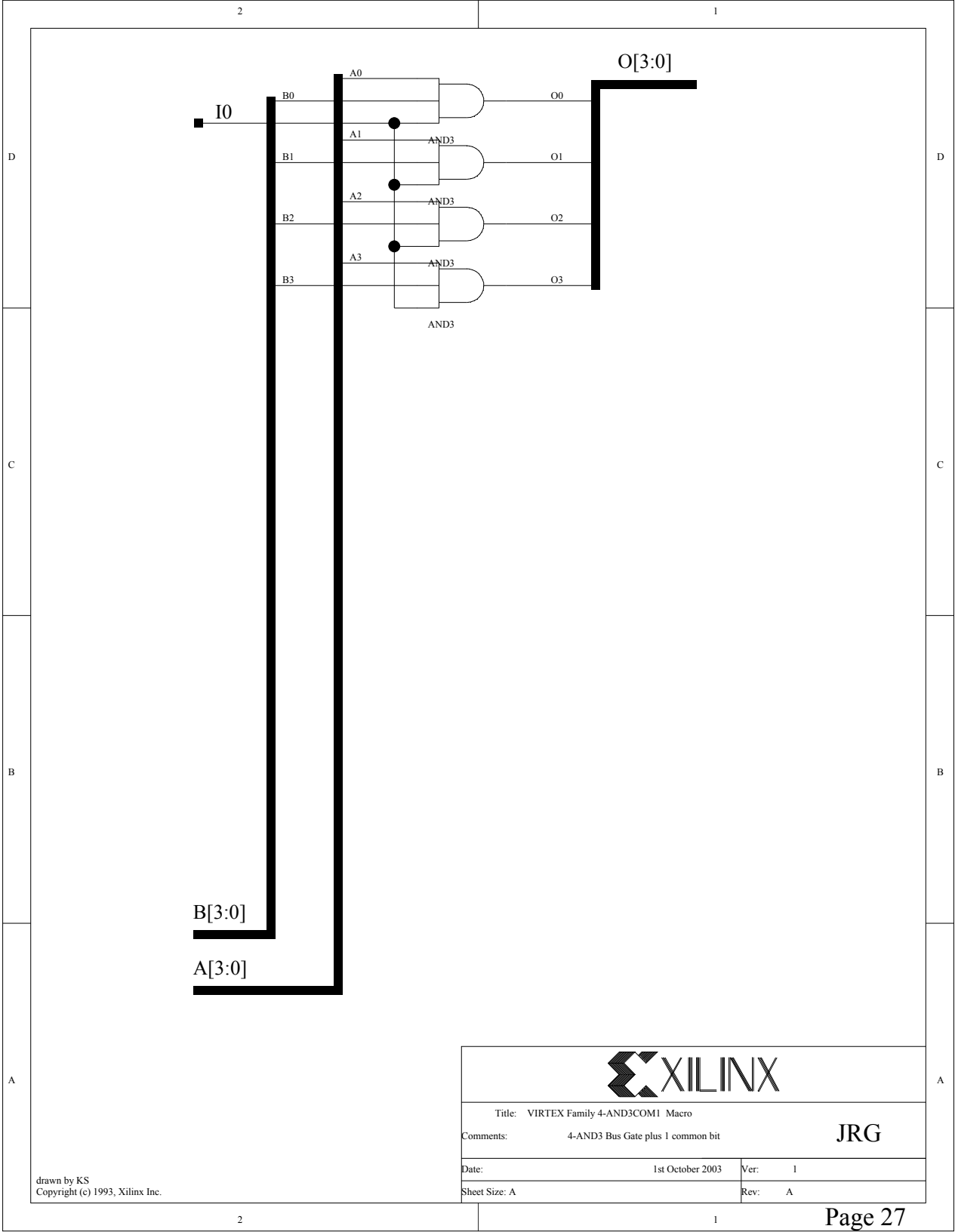
drawn by KS  
Copyright (c) 1993, Xilinx Inc.

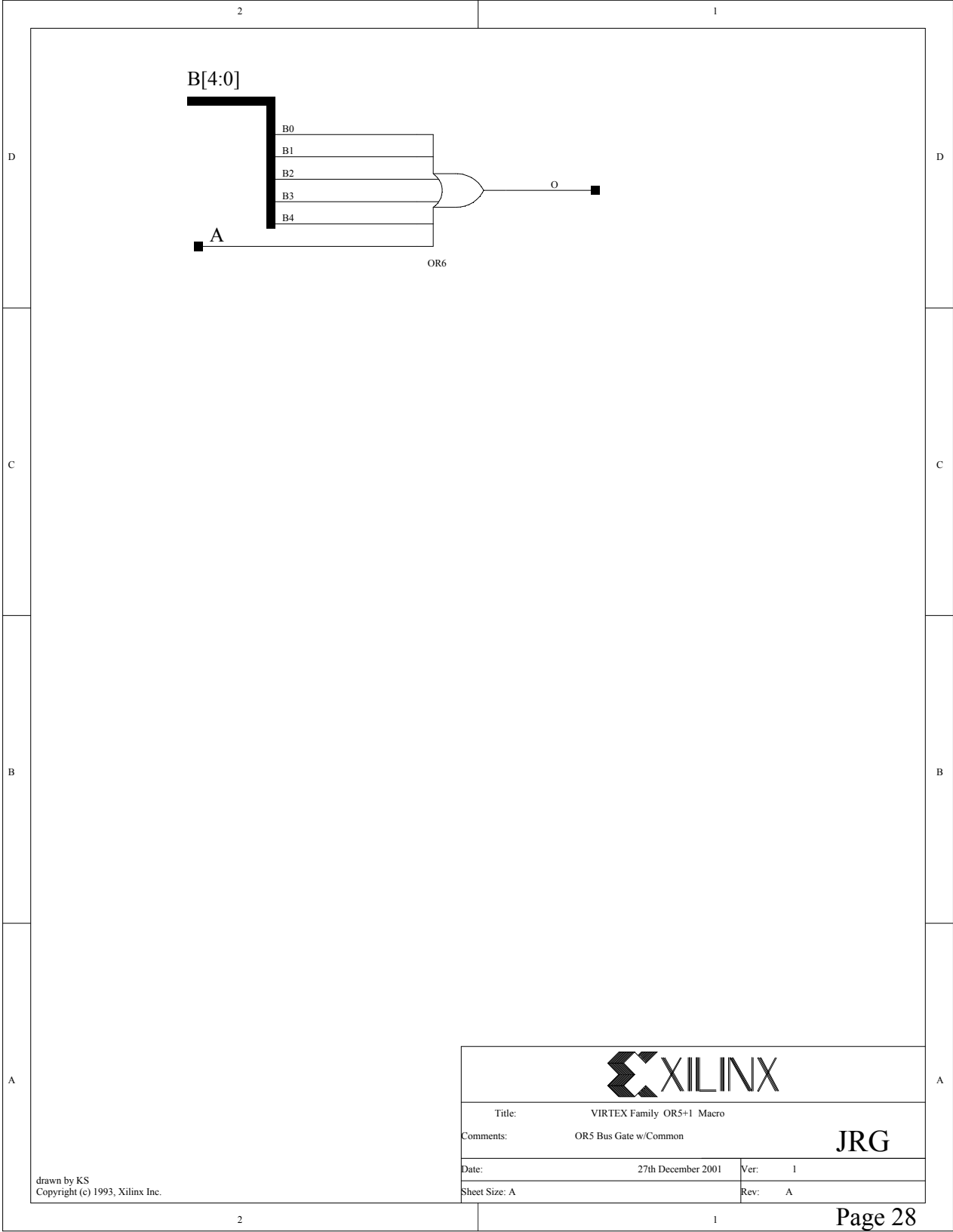


Send 4 Sync bytes:  
 $K28.5(10111100)+D21.5(01011010)$   
 $+K28.5(10111100)+D2.2(001000010)$   
 $= 0x1BC + 0x0B5 + 0x1BC + 0x042$



|               |                                                                                                   |      |     |
|---------------|---------------------------------------------------------------------------------------------------|------|-----|
| Title:        | VIRTEX Family Ethernet Syne Macro                                                                 |      | JRG |
| Comments:     | 9-Bit Data Register w/Feedback, chip enable and output enable to loop through Ethernet Syne cycle |      |     |
| Date:         | 7th August 2001                                                                                   | Ver: | 1   |
| Sheet Size: B |                                                                                                   | Rev: | A   |





|                                  |        |
|----------------------------------|--------|
| Title: VIRTEX Family OR5+1 Macro |        |
| Comments: OR5 Bus Gate w/Common  |        |
| Date: 27th December 2001         | Ver: 1 |
| Sheet Size: A                    | Rev: A |

drawn by KS  
Copyright (c) 1993, Xilinx Inc.

STAT[11:0]

STAT[11:8]

STAT[7:0]

STAT11  
STAT10  
STAT9  
STAT8  
STAT7  
STAT6  
STAT5  
STAT4  
STAT3  
STAT2  
STAT1  
STAT0

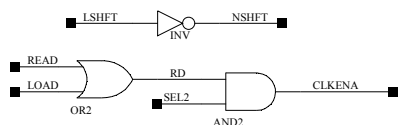
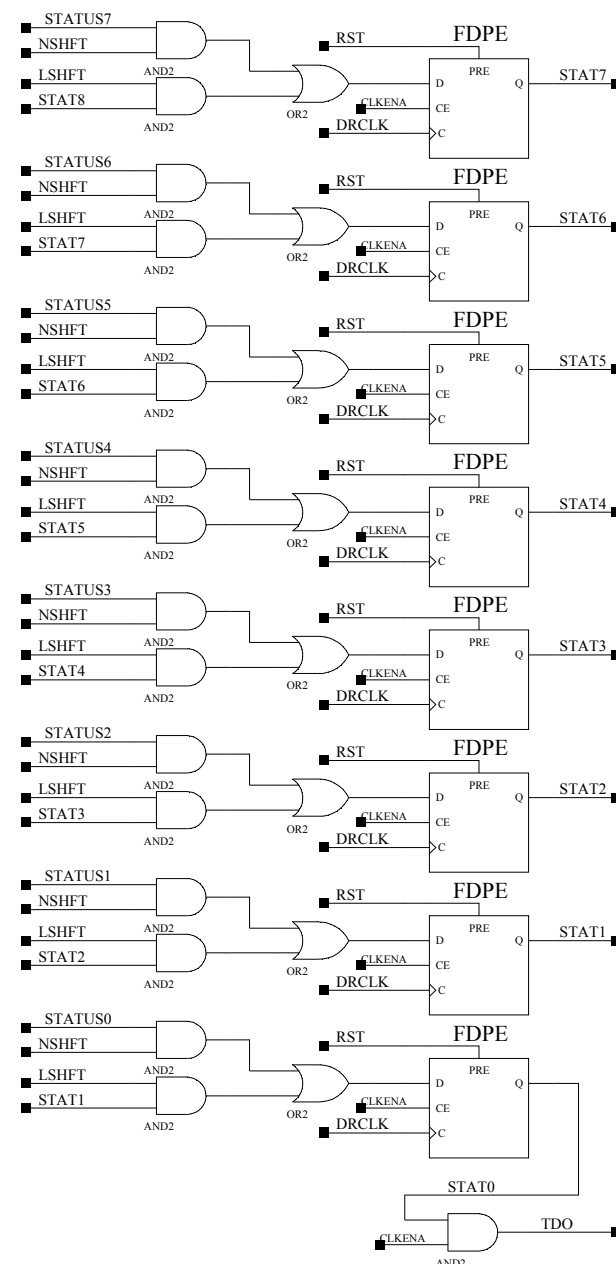
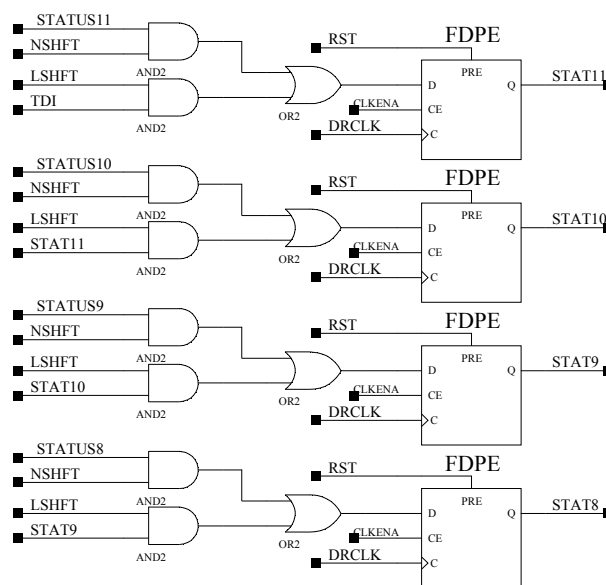
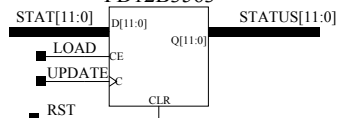
STATUS[11:0]

STATUS[11:8]

STATUS[7:0]

STATUS11  
STATUS10  
STATUS9  
STATUS8  
STATUS7  
STATUS6  
STATUS5  
STATUS4  
STATUS3  
STATUS2  
STATUS1  
STATUS0

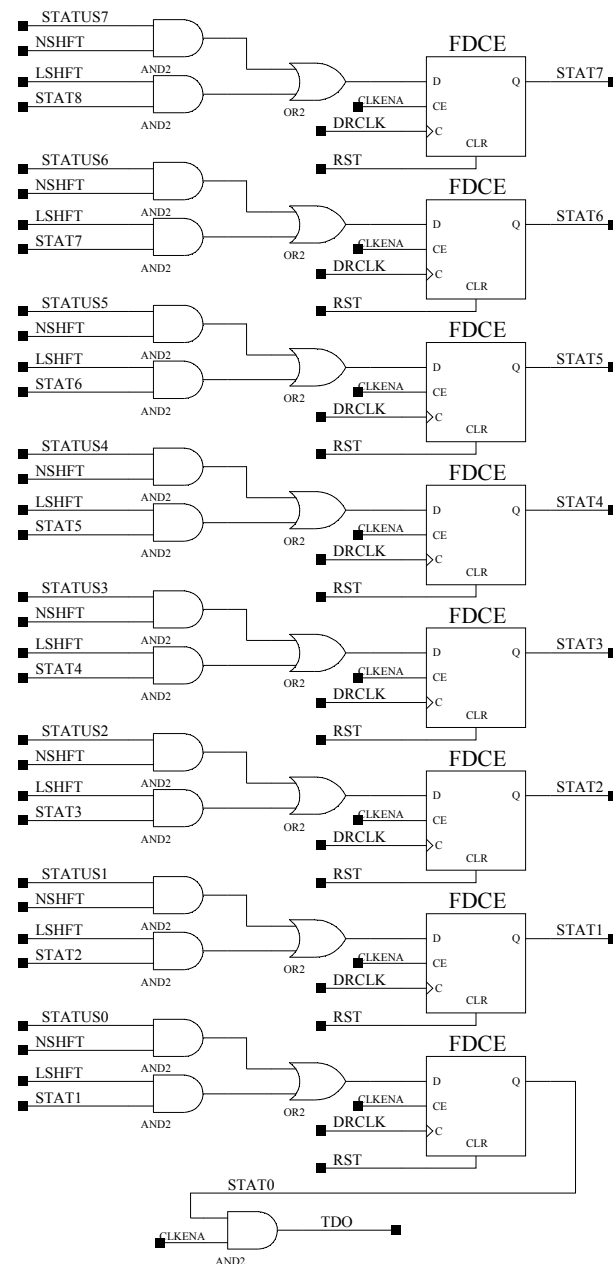
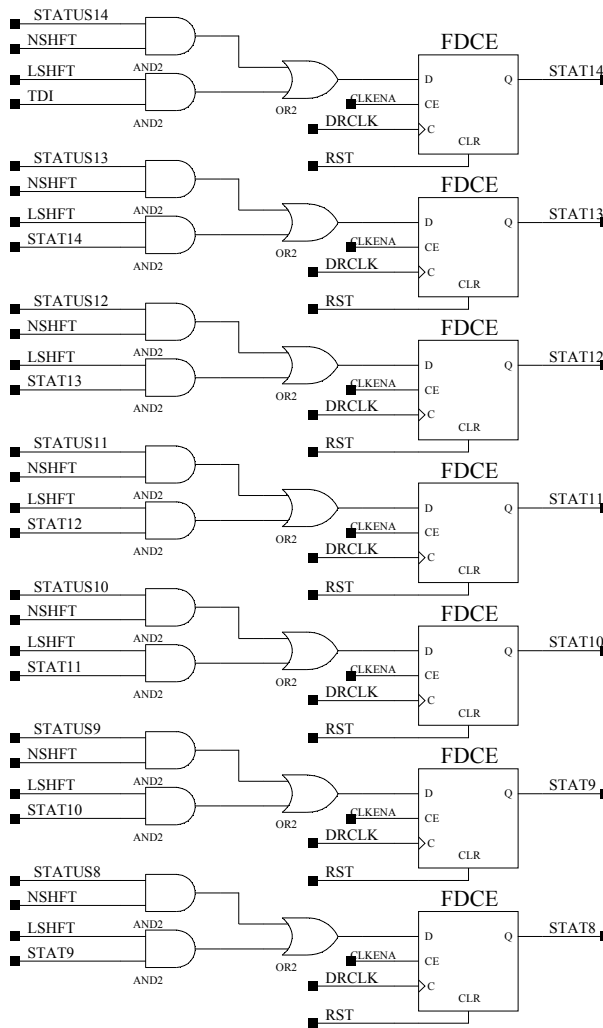
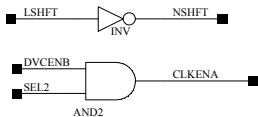
Default=924 BX per Orbit

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FD12B3563

# 15-bit JTAG Register Read out (on DVCENB)

STATUS[14:0]

STATUS14  
STATUS13  
STATUS12  
STATUS11  
STATUS10  
STATUS9  
STATUS8  
STATUS7  
STATUS6  
STATUS5  
STATUS4  
STATUS3  
STATUS2  
STATUS1  
STATUS0

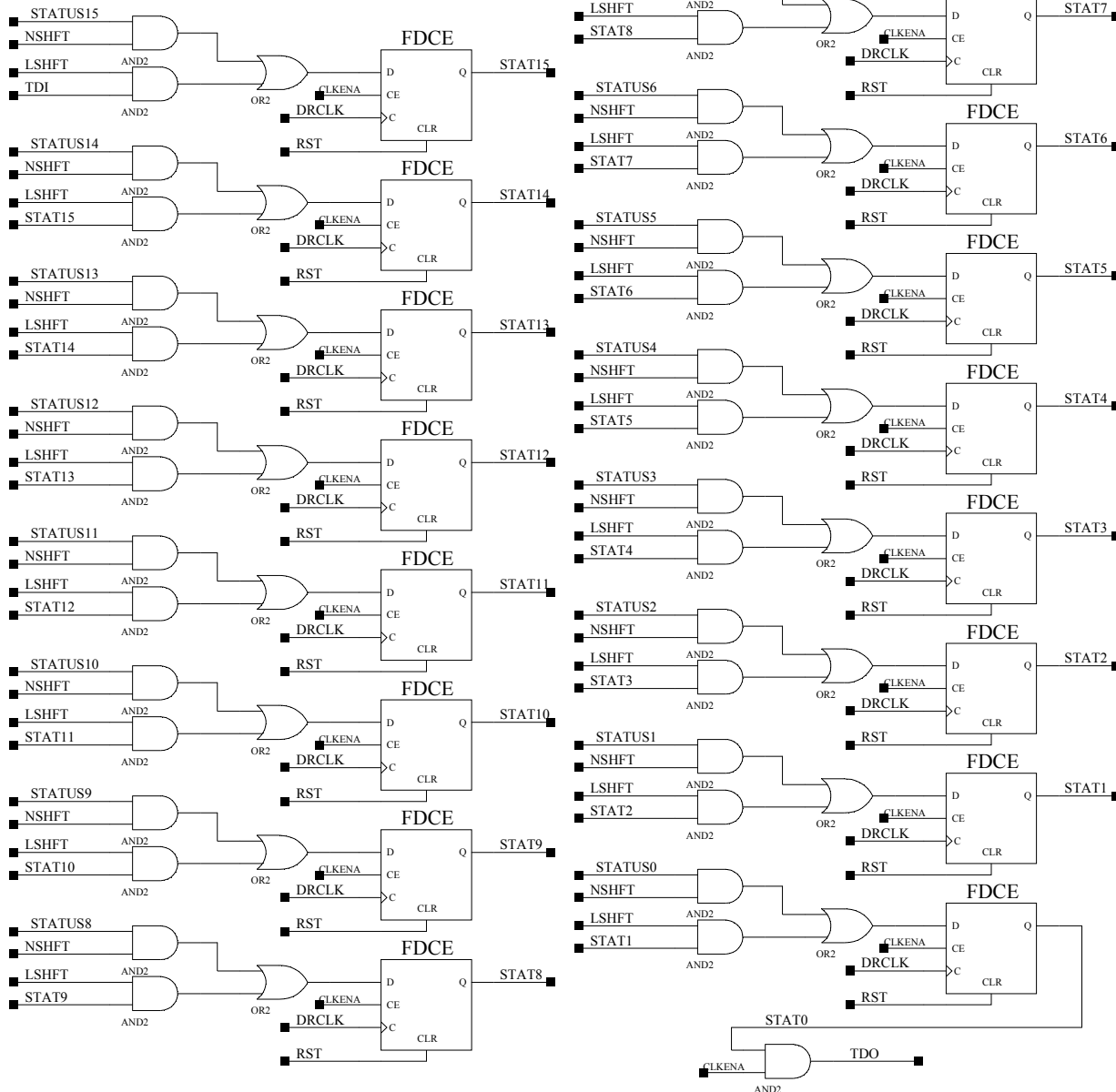
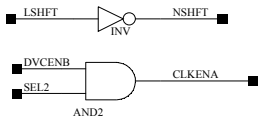




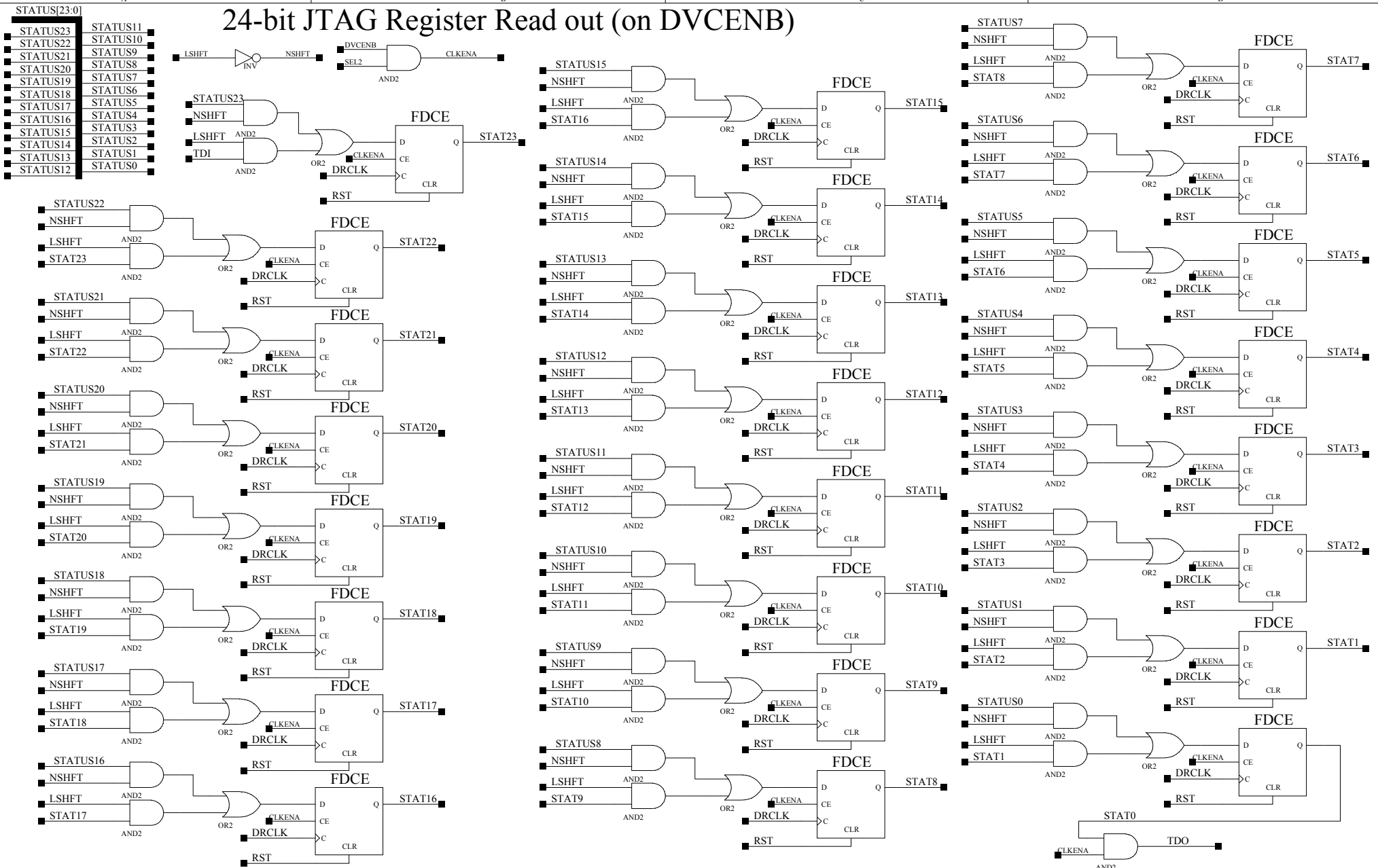
# 16-bit JTAG Register Read out (on DVCENB)

STATUS[15:0]

STATUS15  
STATUS14  
STATUS13  
STATUS12  
STATUS11  
STATUS10  
STATUS9  
STATUS8  
STATUS7  
STATUS6  
STATUS5  
STATUS4  
STATUS3  
STATUS2  
STATUS1  
STATUS0

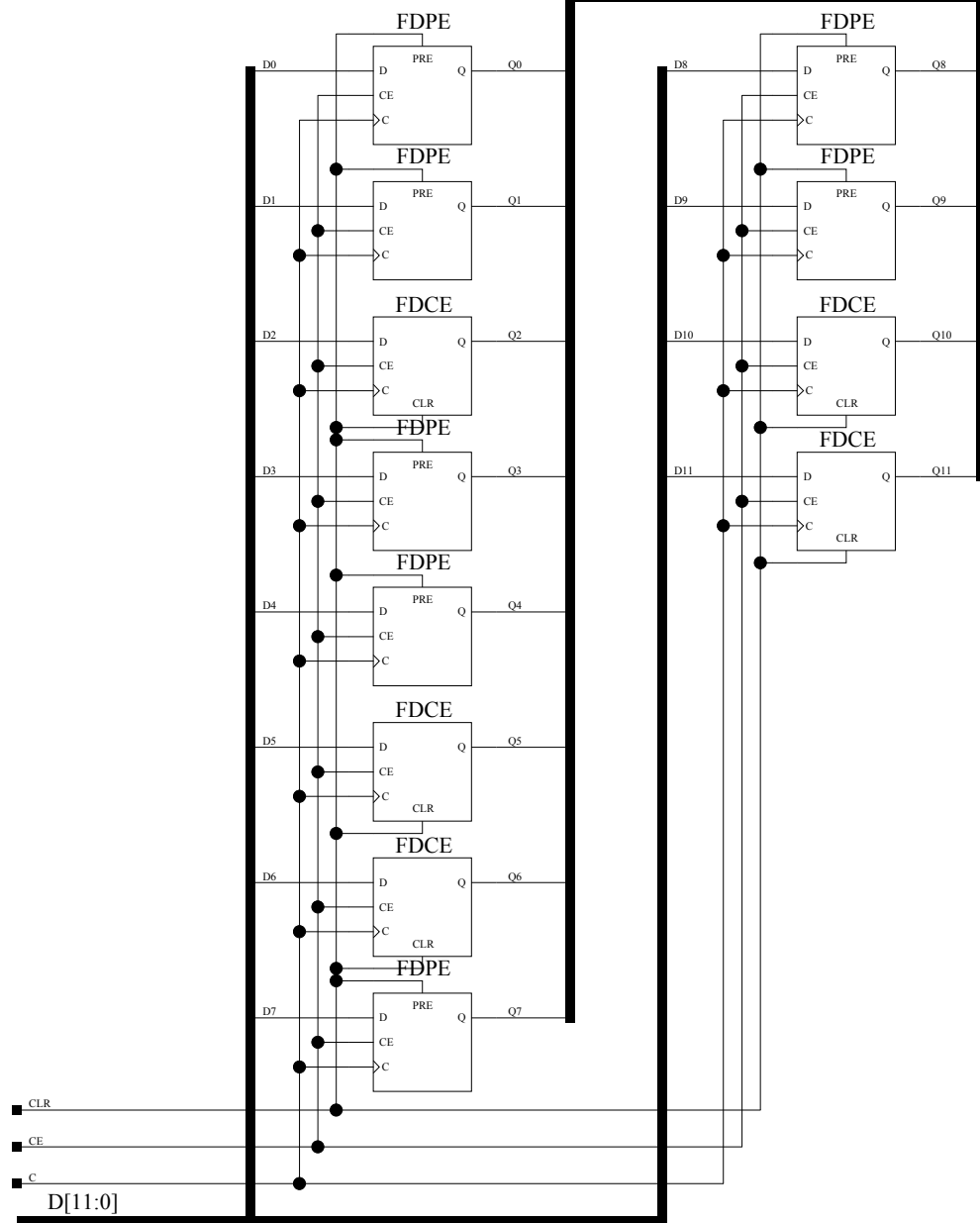


# 24-bit JTAG Register Read out (on DVCENB)



def=923=39Bh=11.1001.1011

Q[11:0]



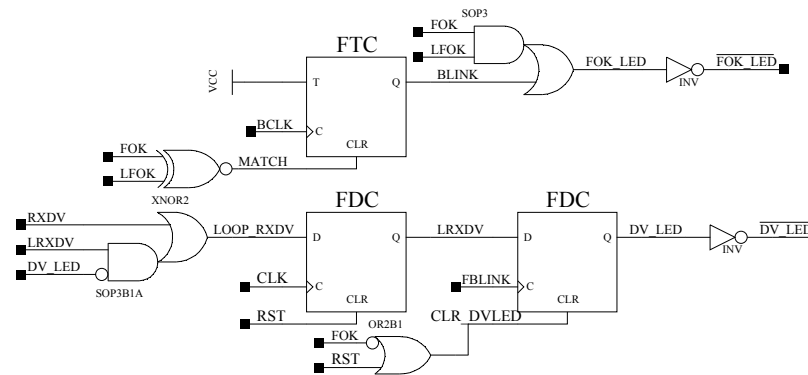
|                                                             |        |     |  |
|-------------------------------------------------------------|--------|-----|--|
| Title: VIRTEX Family FD12b923 Macro                         |        | JRG |  |
| Comments: 12-Bit D Flip-Flop with Preset to 923d and Enable |        |     |  |
| Date: 8th May 2003                                          | Ver: 1 |     |  |
| Sheet Size: B                                               | Rev: A |     |  |

## FOK LED

- LIT == Link is alive and well
- BLINK == Link not ready
- OFF == Link not present

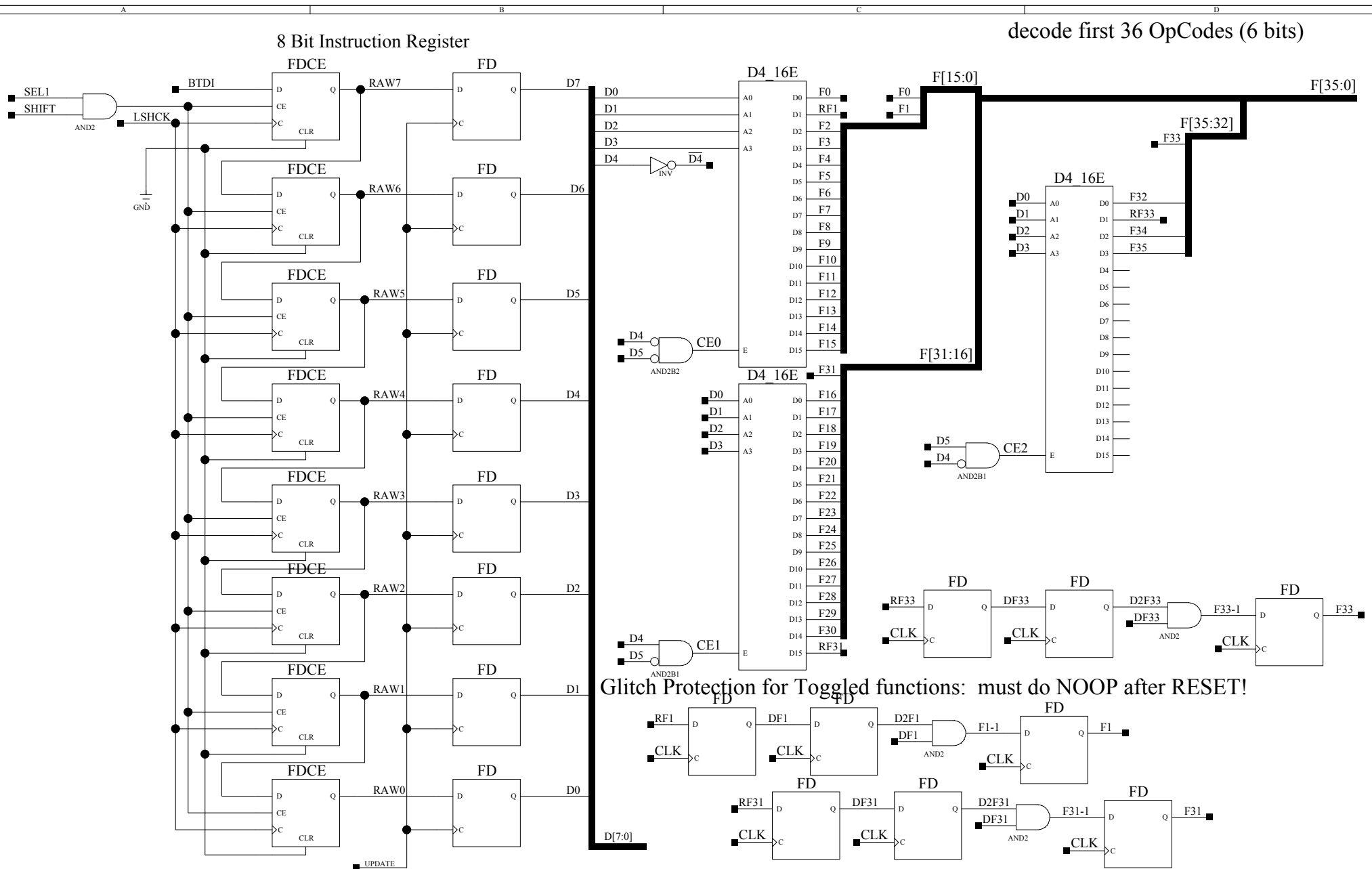
## DAV LED

- LIT == Active Data Xmit
- OFF == No data to Xmit

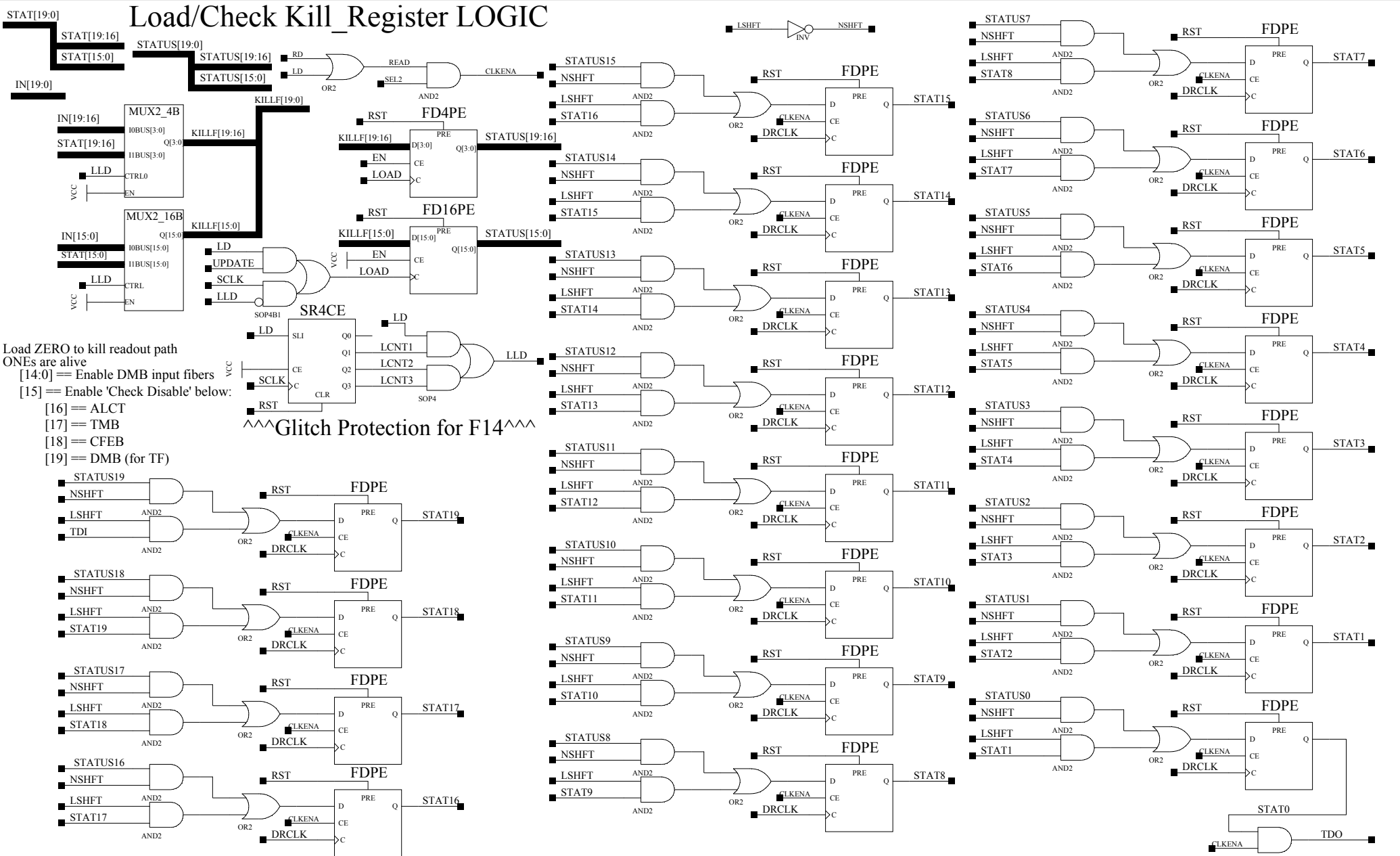


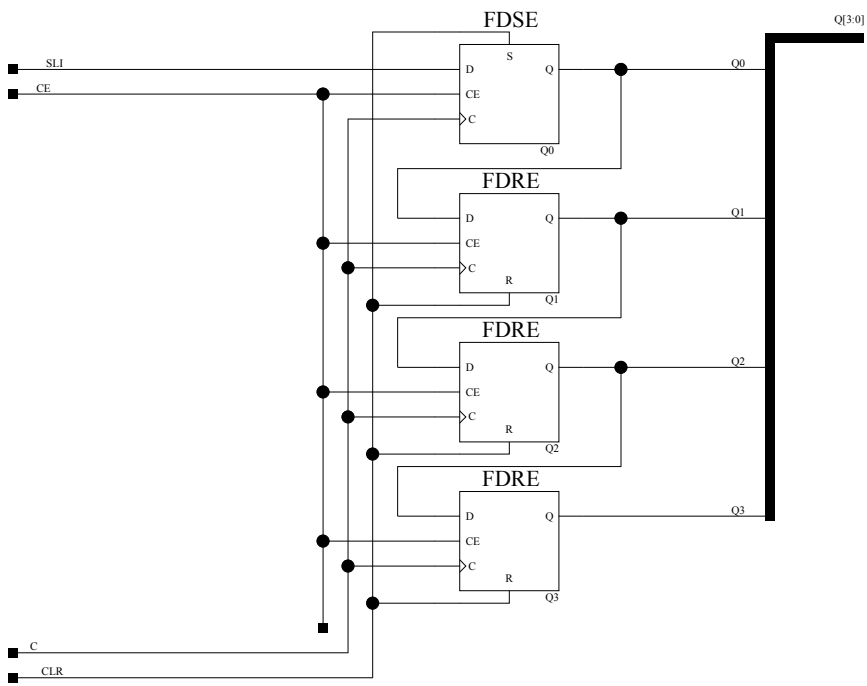
JRG

|             |                                                |      |   |
|-------------|------------------------------------------------|------|---|
| Title:      | FIBERLED                                       |      |   |
| Comments:   | Custom LED Slow-Blink Control for Fiber Inputs |      |   |
| Date:       | 27th January 2004                              | Ver: | 1 |
| Sheet Size: | B                                              | Rev: | A |



# Load/Check Kill\_Register LOGIC

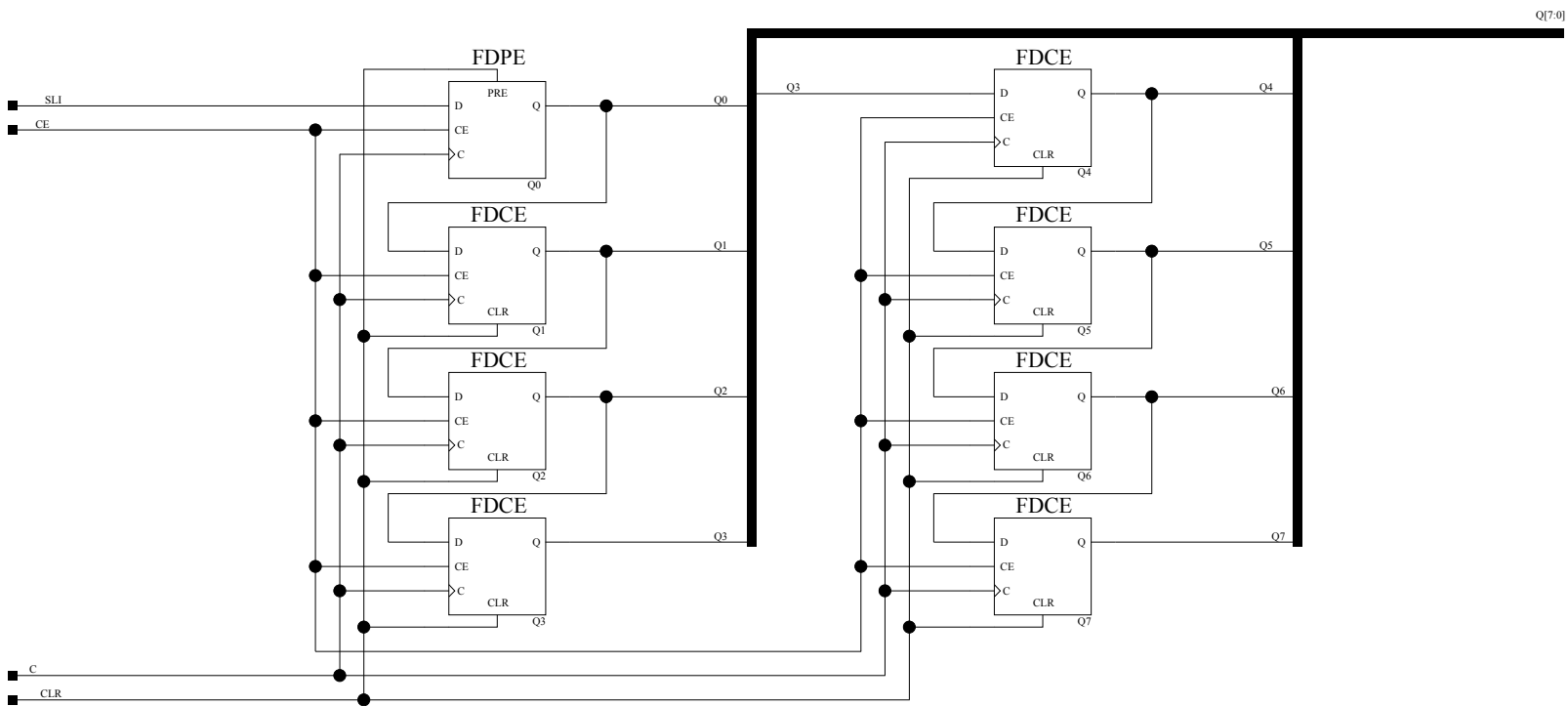




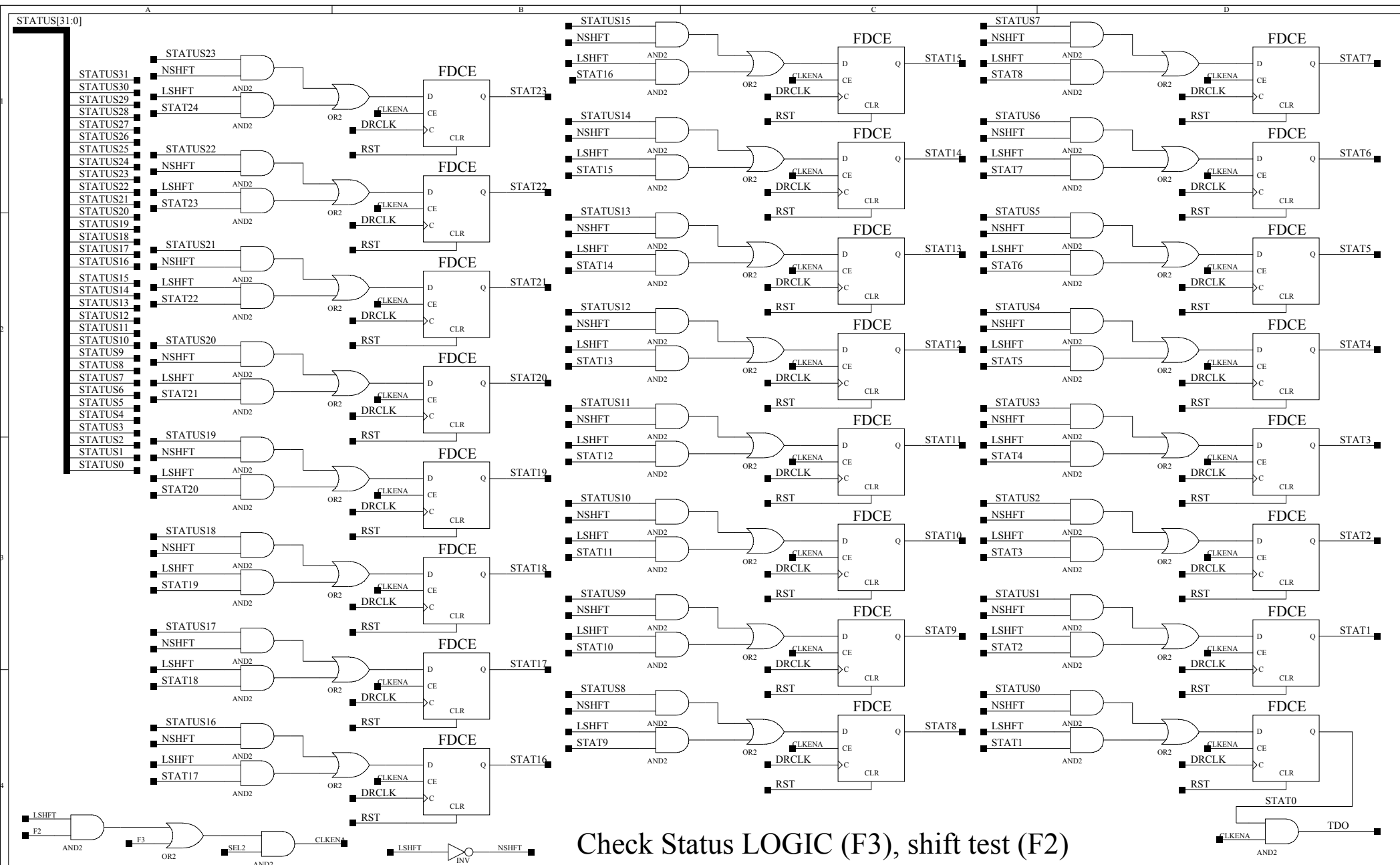
drawn by KS  
Copyright (c) 1993, Xilinx Inc.



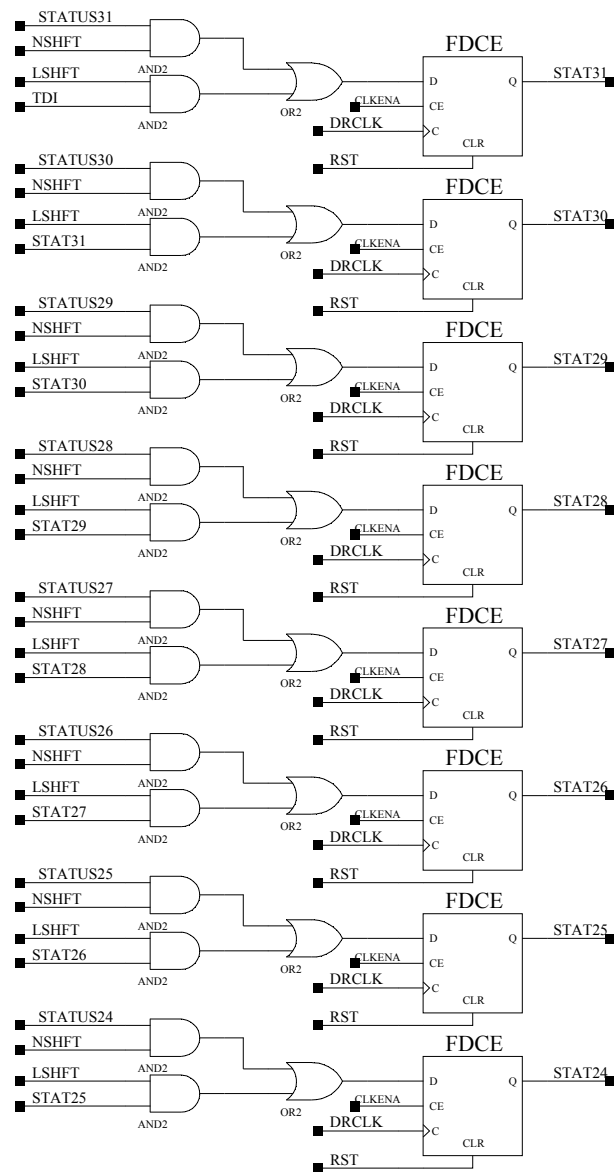
|               |                                                                                              |      |     |
|---------------|----------------------------------------------------------------------------------------------|------|-----|
| Title:        | VIRTEX Family SR4CE Macro                                                                    |      | JRG |
| Comments:     | 4-bit Serial-In Parallel-Out<br>Shift Register w/ Enable, loads a single "one" on Sync Reset |      |     |
| Date:         | 7th August 2001                                                                              | Ver: | 1   |
| Sheet Size: B |                                                                                              | Rev: | A   |

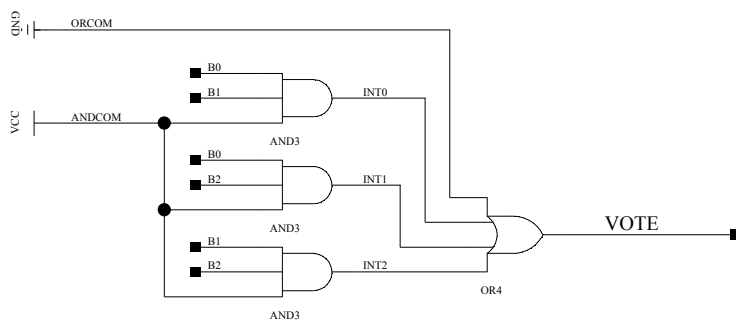


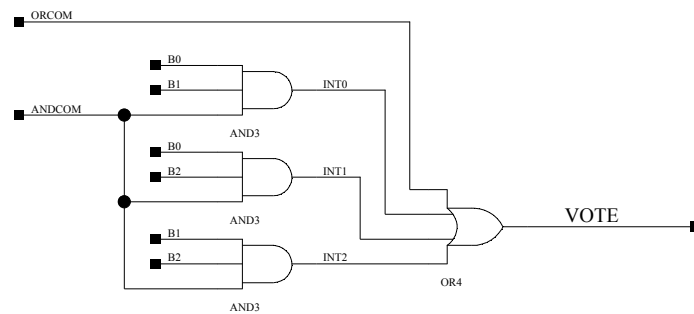




Check Status LOGIC (F3), shift test (F2)







A[15:0]

B[15:0]

C[15:0]

VOTE[15:0]

